IMPACT OF SOCIOECONOMIC CHARACTERISTICS ON THE NUTRITIONAL STATUS OF ADOLESCENTS FROM LOW-INCOME HOUSEHOLDS IN FLORIDA

By

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Although welfare programs have reduced the incidence of poverty in America, there is still no conclusive evidence whether the programs have improved the nutritional status of low-income households. The general assertion that increased food expenditure, via increased income transfer programs, has increased the nutrient intake of low-income households continues to be the subject of national debate. There is also a significant knowledge gap with respect to the nature and dynamics of the links between (a) food expenditure levels and nutrient levels (particularly as evaluated by biochemical nutritional data), and (b) household characteristics, food expenditure and nutritional status. Accordingly, the objectives of this study were (a) to determine the relationship between household socioeconomic characteristics and the level of household food expenditure, (b) to identify the responsiveness of household adolescents' nutritional status to variations in selected

household socioeconomic variables, (c) to determine whether the level of food consumption of the household and the nutritional status of adolescents differ significantly by race, sex and residential location, and (d) to suggest appropriate food and nutrition policy implications resulting from the empirical findings.

The study conceptually followed household economic theory, in which the characteristics of the household are included in the utility function. In this study, the nutrient levels are the food characteristics which become the arguments of the utility function. In line with this theoretical framework, multiple regression analysis (OLS) was used to determine the relationship between household socioeconomic variables, food expenditure and adolescent nutritional status. Adolescent nutritional status was evaluated by eight biochemical parameters: serum folacin, serum iron, red blood cell folacin, hemoglobin, vitamin C, protein, vitamin B_{12} and zinc.

Empirical findings suggested that nutritional education played a key role in increasing low-income households' food purchasing power and nutritional status of adolescents. Although household income, household size and Food Stamp Program (FSP) participation had a significant positive impact on the level of food expenditure, there was no significant evidence that these variables influenced the overall nutritional status of adolescents as measured by the eight nutrient indicators. The highest incidence of nutrient deficiency was among rural households, and rural black households registered the highest incidence of poverty

CHAPTER I
INTRODUCTION

Economics of Nutrition — National Setting

The subject of national food policy has received considerable attention in recent years. Specifically, human nutrition issues have emerged as a major component of policy debate. These issues have reached the point where institutions and legislative bodies have begun to develop and implement provisions for an integrated national food and nutrition policy [7].

The Food and Agriculture Act of 1977 contains major provisions relating specifically to human nutrition research and food policy programs. Major budgetary appropriation is now being given to nutritional research in the departments of Agriculture and of Health and Human Services, both. In the White House, a new advisory group was assigned to advise the president on national and international nutrition and hunger issues [35]. A similar group, the Human Nutrition Policy Committee, was appointed by the Secretary of Agriculture to coordinate USDA nutrition programs, including food assistance, safety, quality, research and education [34].

International agencies such as the United Nations and the World Bank are giving increasing attention to human nutrition and world hunger problems. A recent world food conference in Rome devoted unprecedented attention to problems of malnutrition and hunger. One of the

recommendations emerging from this conference was the founding of a World Food Council to guide the eradication of hunger and malnutrition. The World Bank has also initiated a program of loans to poor countries for malnutrition and hunger projects. The newly opened United Nations University is also offering nutrition related training and research programs [35].

One nutrition expert summed up the problem of malnutrition as follows:

> Nutrient deficiencies that cause widespread disease and debilitation, chronically affect far more people and cause greater cumulative damage than outright starvation. Malnutrition shortens life expectancy. Acute and chronic infections and anemia reduce work output and induce debility. The loss of vitality undermines a person's capacity to save life and the human condition is degraded [11, p. 8].

Authors of the Council on Foods and Nutrition Study [13, p. 272] defined malnutrition as "... a state of impaired functional ability or deficient structural integrity or development brought about by a discrepancy between the supply to the body tissues of essential nutrients and calories and the specific biologic demand for them." Malnutrition not only can be devastating to an individual but also can damage the moral and economic fiber of a nation. The Council on Food and Nutrition pointed out that

> ... hunger and malnutrition is only one of the reasons for the fierce resentments of the U.S. poor. But it is one that can be removed in very large degree. The cost of massive attack upon hunger and malnutrition will be great in money, the cost of doing nothing will be immeasurable in terms of lost human potential and social unrest [13, p. 273].

In order to formulate a sound food and nutrition policy, various

factors affecting the nutritional status of individuals or groups must be identified. First, it is essential that information be available on nutrient requirements for optimum growth and performance among persons of various age, sex, racial and ethnic background, life styles, and residential locations. Second, it is important to relate key socio-economic characteristics of target populations to the nutrient demand configuration of the population. These two information bases are critical, since they permit integration of the biological dimensions of human nutrition (nutrient requirements), with the economic dimension (nutrient demand).

This study attempts to assist in such a task by determining the impact of selected socioeconomic variables on household food expenditures and the nutritional status of adolescents from these households. The households are representative samples of predominantly black low income households residing in urban and rural areas of the state of Florida. This type of data is important because in recent years there has been increased awareness of the strong relationships between socioeconomic characteristics and overall food expenditures and nutritional status of the populations. Unequal distribution of economic and other resources, differences in sociological factors, and the diversity and complexity of channels used to purchase food have resulted in variations in the consumption of food nutrients by households [35]. A review of the general socioeconomic factors affecting nutritional status are discussed below. A review of some of the specific empirical findings directly related to this study are given in Chapter II.

Table 1.--Poverty by family status, sex and race, United States, 1975-76

	1976		1975	
	Number (thousand)	Percent[a]	Number (thousand)	Percent[a]
Total poor	24,975	11.8	25,877	12.3
Head	5,311	9.4	5,430	9.7
Children	10,081	15.8	10,882	16.8
Other relatives	4,240	6.0	4,457	6.4
Male-head families	10,603	6.4	11,943	7.1
Head	2,768	5.6	3,020	6.2
Children	4,497	8.5	5,284	9.8
Other relatives	3,337	5.2	3,638	5.7
Female-head families	9,029	37.3	8,846	37.5
Head	2,543	33.0	2,430	32.5
Children	5,583	32.0	5,597	32.7
Other relatives	903	15.7	817	13.0
Total white poor	16,713	9.1	17,770	9.7
Head	3,380	7.1	3,839	7.7
Female-head	1,379	25.2	1,394	25.9
Children	6,034	11.3	6,748	12.5
Other relatives	2,906	4.7	3,213	5.2
Total black poor	7,593	31.1	7,545	31.3
Head	1,617	27.9	1,513	27.1
Female-head	1,122	52.2	1,004	50.1
Children	3,758	40.4	3,884	41.4
Other relatives	1,201	17.8	1,136	16.9

[a]Percent of total population in the general category who fall below poverty level.

Source: Excerpted from [33].

Table 2.--Poverty level by family, race and residence, Florida, 1976.

Characteristics	Total population	Population below poverty level	Percent[a]
	Number (thousand)	Number (thousand)	
Total	8,493	1,225	14.4
White	7,117	703	9.9
Black	1,320	499	37.8
Spanish	669	122	18.2
Residence			
Nonfarm	8,405	1,203	14.3
Farm	88	22	25.0
Families	2,361	259	11.0
With unrelated children under 18	1,195	72	6.0
With related children under 18	1,166	187	16.1

[a]Percent of total population in the general category who fall below poverty level.

Source [8].

Social Dimension of Undernutrition and Malnutrition in the U.S.

A strong relationship has been noted between poverty status and malnutrition in the U.S. In 1976, according to the official poverty level, there were about 25 million people or 12 percent of total U.S. population below the poverty level. The highest incidence of poverty was among female-headed households (37 percent) and black households (31 percent) (Table 1). The incidence of poverty is considerably higher in black female-headed households. Of all black female heads of households in 1976, 52.2 percent were poor. Female-headed households, children and blacks represent a disproportionately large percentage of the poverty population (Table 1).

In the state of Florida, about 1.23 million persons or 14.5 percent of its total population fell below the poverty level in 1976. Of this number, approximately half a million blacks were below this threshold, which accounts for about 38 percent of the total black population of the state (Table 2). By comparing Tables 1 and 2, one can conclude that Florida has a higher incidence of poverty than the national average.

The nutritional status of households, as measured by calories, protein, calcium, iron, vitamin A and vitamin C, has been shown to be correlated in varying degrees to the household's socioeconomic characteristics. Almost in all income and age categories, more than 60 percent of the U.S. adolescent population were deficient in caloric and iron intakes (Tables 3 and 4). Females and black males tended to have higher proportions of adolescents who had nutrient intakes below the accepted nutrient standards, across income categories. This

Table 3 --Percent of male adolescents aged 10-19 years with nutrient intake below the standard for income levels, by race and age, United States, 1971-74

Nutrient and age	All income			Below poverty level[b]		Above poverty level[b]	
	Total[a]	White	Black	White	Black	White	Black
Calories							
10-11 years	63.2	60.8	82.5	63.7	88.1	60.0	92.0
12-14 years	75.2	73.4	85.4	81.3	82.1	71.9	86.1
15-17 years	70.0	67.6	86.1	86.3	40.4	65.8	68.1
18-19 years	65.4	63.6	72.8	67.1	80.4	63.6	70.4
Protein							
10-11 years	8.1	7.0	15.1	23.2	22.8	5.4	7.4
12-14 years	16.7	15.2	26.5	18.0	31.0	14.2	26.5
15-17 years	26.8	24.9	42.7	37.9	42.6	23.7	44.6
18-19 years	22.9	20.9	25.9	40.0	30.1	19.4	30.1
Calcium							
10-11 years	18.7	15.9	36.4	29.8	52.6	14.1	19.3
12-14 years	16.3	13.9	32.5	15.0	45.2	12.8	25.3
15-17 years	16.0	13.2	37.2	10.7	39.5	13.9	36.3
18-19 years	17.9	14.2	35.8	30.6	48.8	12.8	27.9
Iron							
10-11 years	36.2	33.1	56.5	45.9	78.6	32.0	34.5
12-14 years	63.7	52.2	71.2	67.8	71.8	61.0	72.5
15-17 years	64.1	51.2	82.7	75.2	84.4	59.5	82.9
18-19 years	62.6	59.5	78.4	61.0	63.8	59.9	87.3
Vitamin A[c]							
10-11 years	25.9	23.5	42.0	34.1	55.0	22.5	28.2
12-14 years	51.8	49.5	66.5	55.3	68.9	49.0	64.9
15-17 years	46.2	44.9	63.2	56.0	55.6	44.5	70.1
18-19 years	44.8	40.4	67.2	55.0	79.7	39.8	59.6
Vitamin C[c]							
10-11 years	34.4	32.1	53.6	69.1	65.3	29.0	42.6
12-14 years	38.2	37.7	40.9	49.0	40.8	35.9	32.9
15-17 years	41.8	41.0	50.1	60.0	52.4	39.5	51.1
18-19 years	43.4	41.7	58.0	40.1	57.2	42.0	58.4

[a]Total includes all races

[b]Excludes persons with unknown income

Source: Excerpted from [28, pp. 66, 67, 68, 69, 70 and 71]

Table 4.—Percent of female adolescents aged 10–19 years with nutrient intake below the standard for income levels, by race and age, United States, 1971–74

Nutrient and age	All income			Below poverty level[b]		Above poverty level[b]	
	Total[a]	White	Black	White	Black	White	Black
Calorie							
10–11 years	70.5	69.7	76.2	50.7	76.9	72.9	72.8
12–14 years	86.5	87.8	80.9	81.8	78.4	88.1	84.7
15–17 years	86.8	87.3	83.3	88.3	87.8	87.8	81.2
18–19 years	75.2	75.3	73.9	76.6	54.6	76.0	92.2
Protein							
10–11 years	13.1	19.0	19.0	17.4	16.6	11.1	16.0
12–14 years	40.9	40.4	46.7	43.2	45.8	40.9	48.1
15–17 years	57.9	58.3	54.0	64.7	66.2	57.1	48.0
18–19 years	53.6	44.2	50.8	52.8	42.0	42.5	54.0
Calcium							
10–11 years	26.9	23.9	44.4	34.4	42.7	23.1	40.7
12–14 years	34.2	31.6	50.7	34.5	52.9	31.4	47.5
15–17 years	39.0	37.7	48.5	52.5	60.7	35.1	42.5
18–19 years	48.0	45.2	62.6	60.6	59.4	39.9	68.5
Iron							
10–11 years	92.4	92.1	93.3	81.6	89.9	93.4	95.5
12–14 years	93.1	93.9	90.7	86.0	91.3	94.6	90.5
15–17 years	92.7	92.7	92.8	98.4	96.2	92.9	91.4
18–19 years	92.4	92.4	92.2	97.7	85.4	91.2	100.0
Vitamin A							
10–11 years	37.1	34.0	52.0	37.2	49.8	33.8	50.2
12–14 years	63.1	62.6	68.3	60.5	63.6	62.7	73.9
15–17 years	69.9	69.6	71.0	74.8	77.8	67.5	67.6
18–19 years	67.0	67.5	67.5	67.5	63.8	66.2	69.4
Vitamin C							
10–11 years	38.9	37.5	46.8	38.7	41.0	35.9	52.1
12–14 years	46.5	46.2	52.3	67.8	54.2	44.6	49.4
15–17 years	50.5	50.5	49.5	54.5	51.4	49.5	48.5
18–19 years	42.0	42.0	42.0	51.7	63.3	40.6	47.8

[a] Total includes all races.

[b] Excludes persons with unknown income.

Source: Excerpted from [28, pp. 66, 67, 68, 69, 70 and 71].

distinction is clearly shown in the iron intake category where more than 80 percent of females in the age group 10-19 had intakes below the accepted nutrient standards. In all nutrient categories, the percentage here with intakes below the standards is higher in black males than in white males. In the female category, a higher percentage of white female adolescents were deficient in caloric and iron intakes than were black females. The most striking difference, however, was in the calcium intake category where both black males and black females had intakes much lower than white males and white females. The average percentage of black females with low calcium intake was 52 percent, while it was 34 percent for white females. In the male category, an average of 36 percent was recorded for black male adolescents as deficient in calcium. The average was about 14 percent for white males of similar ages in all income groups (Tables 3 and 4). The nutritional status of households differs by income, age, sex and racial composition.

To assist in the alleviation of income poverty and associated nutritional problems, the government has adopted several federal income transfer and domestic food assistance programs. These programs have grown tremendously in the last ten years. The total federal expenditures for domestic food assistance programs jumped from slightly more than $1 billion in 1969 to more than $10 billion in 1979 (Table 5). The largest expenditure went to the Food Stamp Program (FSP), which amounted to $6.5 billion in 1979, and represented 61.3 percent of total federal expenditures for all food assistance programs. Federal cash expenditures for child nutrition programs rose from $312 million in 1969 to more than $2.7 billion in 1979, an increase of 750 percent. The expenditures for Food Distribution Program and Special Supplemental Food Program for

Women, Infants and Children (WIC) totaled $1,323 million in fiscal year 1979 (Table 5).

Although these programs have reduced the incidence of poverty there is still considerable debate on the extent to which income transfer and food assistance programs have impacted the nutritional status of low income households. Thus despite large public investments, the inter-relationship between income, food consumption and human nutrition are not well identified or understood today [35]. For a sound food and nutrition policy and program implementation, more studies are needed to understand the relationship between nutrient intakes and socioeconomic factors of population at nutrition risk.

Econutrition Research: Problem Setting

Despite increasing levels of public investment in food assistance programs, the nutritional impact of such investment on low income households continues to be the subject of national debate. The debate has been fueled, in part, by the conflicting and inconclusive results of studies which have utilized the 24-hour dietary recall survey method of determining household nutritional status [1]. Increasingly, researchers are advocating the desirability and superiority of biochemical nutrition parameters over the 24-hour dietary recall method [2] [23]. In keeping

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[1] This procedure involves interviews conducted with each sample person about his (her) total food and drink consumption during the past 24 hours. Nutrient values are determined by measuring the respective nutrient intake from each type of food.

[2] In this case, nutritional status is determined from biochemical measurements in blood, urine and clinical evaluation of the subjects.

Table 5 --Federal expenditures for USDA food programs, fiscal years 1969, 1975 and 1979

Program	1969	1975	1979
		Million dollars	
Food stamp	228.8	4,385.5	6,478.1
Child nutrition			2,005.6
School lunch	203.8	1,289.0	224.1
School breakfast	5.4	86.1	281.3
Special food	1.4	99.1	141.1
Special milk	101.3	122.5	
Food distribution			
Needy families	223.9	38.4	18.8
Supplemental food	1.0	17.3	17.5
Schools	272.1	423.4	703.1
Institutions	25.4	20.3	52.6
WIC[a]	--	89.3	530.9
Total	1,063.1	6,571.3	10,457.1

[a]Special supplemental food program for women, infants, and children began January, 1974

Source: Excerpted from [20, pp. 29 and 30]

with the new demand for sound empirical analysis of the new economics of nutrition, this study seeks to identify some of the relevant variables that explain the magnitude of food expenditures and nutrient value of households by using biochemical information. Specifically, accurate information is sought for adolescents from low-income households. As a result of their rapid spurt in growth, adolescents are particularly vulnerable to nutritional stress. These nutritional stress factors increase the demand for sound empirical analysis of the dynamic relationship between the socioeconomic background of the families of adolescents and the nutritional status of the adolescents as a target population.

There is a paucity of information regarding the definitive links between (a) food expenditure levels and nutrient intake (particularly as evaluated by biochemical parameters), and (b) the relationship between household socioeconomic characteristics and food expenditure and nutritional status. In addition to the above mentioned knowledge gap, the problem is complicated by the fact that target group nutritional status is not a simple matter that can be generalized from the perspective of the nation as a whole. National nutritional surveys run the risk of overlooking unique nutritional problems of certain segments of the population. As such, nutrition program planning for target populations might be based on typical and erroneous data. In order to reduce the risk of such a problem, nutritional surveillance must be undertaken for specific populations, as a basis of providing important information on the econutrition problems of important target populations. It is felt that the population groups surveyed for this study are typical of rural and urban adolescents from low income, minority groups within the state and nation. As such, the findings should have national significance for food and nutrition policy.

Objectives

The general objective of this study is to determine the impact of various socioeconomic characteristics on low income household food expenditures and the nutritional status of adolescents from these households in selected areas of Florida. Specific objectives are to determine

(a) The interrelation between household food expenditure and relevant socioeconomic characteristics, such as income, household size, and Food Stamp Program participation.

(b) The impact of household income, family size, educational level and employment status of the household on the nutritional status of adolescents within the household.

(c) Whether the level of food consumption of the household and nutritional status of household adolescents differs significantly by race, sex, age, and residential location.

(d) Appropriate food and nutrition policy implications resulting from the empirical analysis.

Organization

In the introductory chapter (Chapter I), the economics of nutrition and the social dimensions of undernutrition and malnutrition in the U.S. were reviewed and the nutritional problem and the objectives of the study were discussed. Chapter II deals with the new area of econometrics research, and reviews some of the more relevant studies. The theoretical and methodological frameworks are presented in Chapter III, where the traditional consumption theory and the new household economic theory are discussed in reference to nutritional studies. Chapter IV presents the empirical framework including the empirical model, discussion of the independent variables, and the statistical model specification.

The data base and the hypotheses are also presented in this chapter. Food expenditures and other relevant socioeconomic findings are discussed in Chapter V, while the nutritional results are given in Chapter VI. In conjunction with the findings of this study, the important malnutrition issues that confront the public and the U.S. government for effective policy analysis and strategy planning are discussed in Chapter VII. Finally, the general summary, conclusions and recommendations are presented in Chapter VIII.

CHAPTER II

ECONUTRITION RESEARCH: STATE OF THE ART

The dearth of an adequate and relevant econutrition information base has seriously affected the ability of the U.S. government to develop and implement effective food and nutrition policies and programs. However, there is a small body of relevant studies that has led the way in gleaning important information on the links between socioeconomic parameters and the nutritional status of target populations. Some of the more relevant studies are reviewed below.

DHEW: Ten State Nutrition Survey (TSNS) 1968-1970

The general objective of the survey [37] was to provide an accurate assessment of the degree of malnutrition in the U.S. The late 1960's evidenced an increased awareness of the fact that hunger and malnutrition were widespread throughout the United States. Under the auspices of the Department of Health, Education and Welfare (DHEW) an act was passed by Congress to undertake a survey of the incidence and location of serious hunger and malnutrition. Ten states were selected to represent the broad diversity of economic, ethnic, and social-cultural composition of the total population.[3] The survey instruments were so designed as to obtain a representative sample of poverty level households, on the basis of

[3]The states included in the study were: California, Kentucky, Louisiana, Massachusetts, Michigan, New York, South Carolina, Texas, Washington and West Virginia.

preliminary evidence that these households represented a disproportionate number of the undernourished and malnourished segment of the population. Biochemical and dietary data were obtained from approximately 40,000 individuals and demographic data were collected from 24,000 families, containing over 86,000 persons. Results of the survey showed that a significant number of persons had calorie intake below the recommended standard for their age, size and weight. In particular, for adolescents, pregnant women and persons over 60 years of age, the mean caloric intakes were lower in the low-income categories and were lowest among blacks. A major conclusion of the survey was that young people in all subgroups of the sample had a significant incidence of vitamin A deficiency, low hemoglobin and iron deficiency. Low hemoglobin concentration was more acute among low income adolescent males than among low-income adolescent females. Vitamin C, iodine, riboflavin and thiamine were not found to be major problems in any of the groups studied.

In summary, the biochemical data in the Ten-State Nutrition Survey confirm the existence of inadequate nutrition among a large segment of the target population. For example, in the low-income states, 58 percent of the total population had deficient or low values in at least one of six biochemical parameters. In contrast, deficiency rate was only 32 percent in high-income states.

Some of the policy recommendations resulting from the survey were: (a) increased basic research in nutrition and health, including adequate and accurate nutritional information, (b) increased income and cash maintenance programs in association with public and health education programs through formal and informal channels, (c) direct cash payments to selected families where employment opportunities are not available in the foreseeable future.

DHEW: Preliminary Findings of the First Health and Nutrition Examination Survey (HANES), 1971-1972

The HANES program [36] was undertaken by the National Center for Health Statistics in response to a directive from the Department of Health, Education and Welfare. The purpose of the study was to measure the nutritional status of representative samples of the U.S. population and establish a continuing national nutrition surveillance system to be used as an improved basis for health and nutrition studies. Two measurement procedures, the 24-hour dietary recall and biochemical tests, were used to assess nutritional status. The findings of the HANES study were based on the examination of the 10,126 persons aged 1-74 years. The findings are summarized below:

Dietary Parameters: Twenty-four hour recall data were analyzed to compare nutrient intake by income levels, race, sex, and age. The results showed that white persons in the higher income level had the highest calorie intakes, while blacks in the lower income group had the lowest intakes. Mean protein intake showed little or no variation by race or income within most age groups. Mean nutrient intakes for calcium and vitamins A and C approached 90 to 100 percent of the Recommended Dietary Allowance (RDA) for most age, racial and income groups. In all age groups and at both income levels, the mean calcium values were consistently higher for whites than for blacks. Race and income levels in HANES do not appear to be associated with differences in mean iron intakes in the age groups less than 18 years. The iron intake of adolescents in both races and both income groups was below the RDA

Females of ages 18-44 years also had intake below the RDA

Biochemical Parameters The biochemical data provided evidence of iron deficiency with anemia for children and adolescents of ages 1-17 years, based on a relatively high percentage of low transferrin saturations. Thirty-two percent of adolescents (12-17 years) had low transferrin saturations. Racial differences in serum iron appeared to be important, with blacks usually having lower values. In the 12-17 years age group the percent of low values for hemoglobin and hematocrit was four to six times higher in blacks than in whites, regardless of income. Whites had a higher prevalence of low serum protein values.

The HANES study concluded that the preliminary data permit only limited general conclusions concerning the nutritional status of the U.S. population. However, both the dietary intake data and biochemical measurements showed that there is a significant incidence of iron deficiency in all race, sex, and age groups, regardless of income.

NUTRITION CANADA: Report on Relationship Between Income and Nutrition Based on the Analysis of Nutrition Canada Data (1970-72), 1973

The objective of the study [9] was to assess the extent to which nutritional status, as determined in the Nutrition Canada Survey (1970-1972), was associated with economic status. Each of the eight biochemical parameters observed was regressed on the size and economic status of the household. The results of the Nutrition Canada Survey showed strong evidence that lower income status most adversely affects the nutritional status of older children and adolescents (10-19 years), of both sexes, and middle-aged persons (40-64 years). Lower income

tended to have more of an effect on the nutritional status of women (20-64 years) than on men of the same ages. There was a clear relationship between vitamin C and economic status. Households in the low-income category were more deficient in the nutrient than were households in the higher income category. The same results were found for folic acid levels in most groups, particularly among young and middle-aged women (20-64 years), and among elderly men (65+ years). The prevalence of anemia among these same groups was also related to income. Iron deficits, as measured by serum transferrin saturation, were related among children and adolescents (5-19 years) of both sexes to income level. No relationship was found between income and nutrients such as serum protein, serum cholesterol and mean hemoglobin concentration.

In conclusion, the study showed that nutritional status and income are related and that often the risk of nutritional disease is highest in the lowest income category. The authors concluded that the complex relationship between income and nutrition would become clearer when the relationship between income and patterns of food consumption was examined.

LANE: Food Distribution and Food Stamp Program Effects on Food Consumption and Nutritional Achievement of Low-Income Households in Kern County, California (1976)

The questions addressed in this study [19] were: (a) Did the Food Distribution and the Food Stamp Programs result in an increase in food consumption? If so, did increased consumption improve levels of nutrition? (b) If they did, which of the two programs was the more effective?

The study was based on 1972-1973 data from a survey of 593 households, comprised of 2,813 persons. Respondents were questioned concerning food consumed at home in the 24 hours prior to the interview. Nutrient Achievement Ratios (NAR's) were used

as comparative measures of nutrient intakes. The NAR's, as dependent variables, expressed the amount of particular nutrient consumed by a member of a household as a percentage of the amount of that nutrient recommended for that individual [4]. The nutrients considered were calories, protein, calcium, vitamin A, vitamin C, iron, niacin, riboflavin, and thiamine. Independent variables included in the study were income, household size, family composition, food aid status, race and frequency of pay, to name a few.

Results showed that both the Food Stamp Program (FSP) and the Food Distribution Program (FDP) affected nutrient intakes. Nutritional response was associated with (a) the increased cash outlays made for food as a result of the income supplement of the FSP and, (b) the increased availability of food items through the FDP. All nutrient intakes, with the exception of vitamin A and vitamin C, showed higher values for FSP and FDP participating households compared to non-participating households. Nutrient achievement levels were also found to differ according to ethnic group, residence, family size and the educational levels of households.

To improve the diets of the poor, the author recommended the following:

(a) Increase the access of the poor to food by providing them with higher and stable income.

(b) Increase their level of education, nutritional knowledge and skills in food selection, preparation, storage and use.

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[4] The nutrient recommendations are daily standards established by the Recommended Dietary Allowances (RDA's) of the Food and Nutrition Board, National Research Council of the National Academy of Sciences. The allowances are adjusted to reflect sex and age differences.

[illegible] tion facilities for better quality [illegible]

[illegible] [1] Impact of Socioeconomic Factors on Consumption of Selected Food and Nutrients in the United States (1976)

This study [1] was based on a nationwide household food consumption survey of 1950 households conducted in 1965-1966. Multiple regression analysis was used to estimate the impact of socioeconomic factors on selected nutrients. The quantities of the respective nutrient consumed per household were computed by multiplying the quantity of each food consumed per week in the household times the percent of each nutrient available in each unit of food. This method is similar to that of the 24 hour dietary recall method, except that the length of consumption increased from one day to seven days.

Although individual nutrient consumption was found not to be highly responsive to higher income levels, results of the study indicated that income had a positive impact on the consumption of all nutrients, except carbohydrate. The results also showed that nutrient consumption differs by race and degree of urbanization. For instance, farm households consume more of all nutrients, except vitamin A and vitamin C, than do urban households. In regard to racial difference, it was noted that black households consumed less carbohydrates, calcium, and thiamine than did either white or other racial types of households. The authors came to the conclusion that food and nutrition programs could possibly be more effective if directed towards urban, less educated and black households.

WEST AND PRICE: The Effects of Income, Assets, Food Programs and Household Size on Food Consumption (1976)

This study [39] used a 1972-1973 sample of households which contained 5 to 12-year-old adolescents in the state of Washington. Regression analysis was used to answer a number of questions posed, such as: (a) How is the value of food consumption effected by receipt of Food Stamps and Free Lunch? (b) Have the relative impacts of income and household size on food expenditures changed?

The dependent variable in the analysis was the value of food consumed, including food purchased with bonus Food Stamps, free school lunches, food produced in gardens, and meat obtained through hunting and fishing. The independent variables considered were income, assets, household size, Food Stamp Program participation, length of pay period, level of education and race. Income, assets and Food Stamp values were adjusted to Equivalent Adult Scales, following procedures used by Freis and Houthakker [27] and Price [28].[5] Results indicated that bonus Food Stamps, assets and length of pay period significantly increased the value of food consumed. Income showed a relatively small effect on the value of food consumed. Two explanations were given for this effect. First, the range of observations did not include households with very low income, where food expenditures may be more responsive to income.

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[5]This approach standardizes the differences in family size, age and sex of household members. Scales are derived from analysis of household behavior, rather than from nutritional standards. Index values are assigned to household food expenditures, where the weight for the first adult is 1.0 and then is proportionally less for each other household member

Second, the value of food consumed included food from nonmarket sources, some of which may be less sensitive to income changes

For policy planning, the authors recommended the following:

(a) The amount of assets owned should be considered as a criterion in determining eligibility for food distribution programs.

(b) Household sizes should also be considered for eligibility in food delivery programs.

(c) Adoption of short pay periods and frequent allocations of food stamps should be considered for effective results.

MADDEN AND YODER. Program Evaluation: Food Stamps and Commodity Distribution in the Rural Areas of Central Pennsylvania (1972)

The primary purpose of this pioneering study [22] was to find out if the dietary intake of poor families was enhanced as a result of food aid program participation. Three food aid programs were selected for analysis. These were: (a) the Commodity Distribution Program (CDP), (b) the 1969 Food Stamp Program (FSP_1) and (c) a 1970 revised version of the Food Stamp Program (FSP_2) which included modifications adopted in April of 1970.

It was hypothesized that families who remained in the food aid programs would have improved diets as they moved from the CDP to FSP_1 and then to FSP_2. A mix of 24-hour dietary intake data was collected from each of 1001 families in two counties of Central Pennsylvania. Each family's income, participation or nonparticipation in CDP, FSP, and the Expanded Food and Nutrition Education Program (EFNEP) were evaluated in the study. The results showed that: (a) low-income families were most deficient in vitamin A and calcium, and least deficient in phosphorus

protein, (b) CDP families had no better diets than non-CDP families with similar characteristics, (c) FSP participation enhanced the diets of families only if the family had net received income for a period longer than two weeks, and (d) total value of food purchased by the families surveyed did not increase significantly with the introduction of FSP. The authors made the following recommendations:

(a) Given that nutritional inadequacy is most likely to occur two weeks or more after the family receives its pay, a pilot study should be conducted in which low-income families now getting social security, retirement, and other income once a month would receive their checks more frequently.

(b) Foods which have a very low dietary value per dollar of cost, as determined by nutrition specialist, could be declared ineligible for purchase with food stamps. Foods such as soft drinks and snacks that have minimal nutritional value would be deleted, as well as high priced prestige items (such as high-priced cuts of meat) that may be nutritious but have a low nutritional value per dollar.

(c) Further research is needed to determine the relative effectiveness of in kind versus cash aid to the poor. Specifically, if the CDP or the FSP ratoil value is given to families in cash rather than in kind or stamps, would there be a higher dietary intake?

NEENAN AND [illegible] Impact of Food Stamp Program on Low-Income Household Food Consumption in Rural Florida (1977)

The general objective of this study [25] was to identify socio-economic determinants of food expenditure levels for Food Stamp Program participants and eligible nonparticipants in a rural area of Florida. The study utilized 1976 survey records of Expanded Food and Nutrition Education Program (EFNEP) participants in conjunction with a 24-hour dietary survey administered during the spring of 1976.

The results of this study showed that income and family size explained a significant proportion of the variation in food expenditures among both FSP participants and eligible nonparticipants. For program participants there was an indication of strong interaction between the value of bonus food stamps and both income and family size. A positive bonus value-family size interaction implied that bonus value might have been effective in increasing food expenditures as family size increased.

A negative bonus value-income interaction also suggested that the bonus value impact may have been greater at lower income levels and less effect as income rose. Despite the negative relationship between bonus value response and income response, food expenditure increased with increasing bonus value until a monthly income level of $700 was reached. A strong income related food expenditure response was also found for eligible nonparticipants. This income response was greater than that of FSP participants. Family size was significant in explaining food expenditures for both FSP participants and eligible nonparticipants. However, the family size coefficient of FSP participants was considerably larger than that of the nonparticipant group.

No other explanatory variable was found to be consistently statistically significant in explaining total food expenditure variation. It was noted, however, that among eligible nonparticipants the coefficient for female-headed households was consistently negative, while in the FSP participant sample there was no difference in the food expenditure of female and male-headed households. This suggested that the FSP may be operating as an income equalization measure between male and female-headed households.

DAVIS AND NEENAN — Impact of Food Stamp and Nutrition Education Programs on Food Group Expenditure and Nutrient Intake of Low-Income Households (1979)

This study [14] represents a companion study to the Neenan and Davis 1977 study [25] reviewed above. The authors utilized the same data base that was used in the earlier study. The objectives of this study were to: (a) identify selected food group and corresponding nutrient intake responses associated with participation in the FSP and EFNEP, (b) simulate the nutritional impact of alternative policy mechanisms with joint FSP and EFNEP participation, and (c) explore policy implications for food and nutrition program planning. Nutrient responses were evaluated in terms of the expenditure levels and impacts of four food groups (meat, dairy products, fruit, and bread and grain products) on protein, vitamin A, vitamin C, calcium and iron.

Regression results were as follows: (a) nutrient adequacy of protein, calcium, vitamin A, and vitamin C, were not consistently related to either money income or bonus income from Food Stamps, (b) participation in FSP and EFNEP affected total food expenditures and nutrient adequacy of protein, calcium, iron, vitamin A, and vitamin C,

(c) policies which combine income supplement program, such as the FSP with nutrition education programs such as EFNEP, were more effective than either program, taken individually, for increasing the nutrient levels of low income households, and (d) a joint FSP/EFNEP participation was nutritionally superior to direct cash supplement or a joint cash-EFNEP program among low income households

SCEARCE AND JENSEN Food Stamp Program Effects on Availability of Food Nutrients for Low-income Families in the Southern Region of the U.S. (1979)

Scearce and Jensen [30] used 1972-1973 Consumer Expenditure Survey data to (a) estimate the effects of the Food Stamp Program on the amount of selected nutrients purchased by low income families in the southern region of the U.S., and (b) estimate the effects of other socioeconomic factors on the availability of nutrients for these low income families

The authors concluded that (a) if all other factors are held constant, participation in the FSP significantly increased the amount of six of the nine nutrients examined, (b) family income and educational level of the homemaker impacted positively on the amount of nutrients purchased, (c) urban low income families had lower levels of purchased nutrients that did rural low income families, and (d) without the FSP, participating households would have had less energy (calorie), protein, calcium, iron, vitamin A, and vitamin B.

The above studies represent important contributions to our understanding of the economics of human nutrition. However, all of these studies, with the exception of the Ten-State Nutrition Survey (TSNS)

and the Health and Nutrition Examination Survey (HANES), were based on nutrient assessment by using the 24-hour dietary recall procedure. From this point of view, there is some question regarding the soundness of their informational base for nutrition policy and program formulation. The present study seeks to improve and refine the existing nutritional information base by determining the impact of selected socioeconomic variables on target population nutritional status as determined by biochemical and clinical parameters.

CHAPTER III
THEORETICAL AND METHODOLOGICAL FRAMEWORK

Traditional Consumer Demand Theory

The traditional theory of consumer behavior is predicated on the view that the consumer unit maximizes utility by direct consumption of goods and services purchased in the market place, subject to a budget constraint. The functional utility maximizing model is expressed mathematically as

$$\text{Maximize } U = f(q_1, q_2, \ldots q_n)$$

Subject to

$$\sum_{i=1}^{N} P_i q_i = M$$

where q_i are goods purchased in the market, P_i are their respective prices, and M is the money income constraint. Using the first order conditions, demand functions are derived from the above utility function and are expressed in the functional form

$$q_i = f(P_i, M) \quad i = 1, 2 \ldots n$$

To measure the theoretical plausibility of empirical demand equations, one has to make sure that the general restrictions of consumer's demand theory are satisfied [25]. The four general restrictions as stated by Phlips [26] are: homogeneity, symmetry, negativity of the own substitution effect, and the adding-up condition (Engel aggregation). Four methods of estimating demand functions are identified by Sagali [3]:

specific utility, traditional theory constrains imposed on a specific form of demand function, total differentials, and separability. According to Phlips the easiest way to impose all general restrictions simultaneously is to derive the demand equations from a specified utility function.

The traditional consumer demand theory has been frequently modified by economists to broaden its range of applicability. However, these modifications have not altered the fundamental weaknesses of the traditional approach. The major weaknesses of traditional demand theory as cited by Becker [5], Lancaster [18], and Ragali [3] are:

(a) The traditional theory has generally been formulated in terms of monetary prices and monetary income whose application has tended to be restricted to the market sector. Decisions about the allocation of a consumer's nonmarket factors such as time, choice of religion, marriage, family size, atheicity, and sex have often been ignored by traditional theory.

(b) The theory lacks predictive power for all possible goods, including new commodities and qualitative changes.

(c) All intrinsic properties of particular goods have been omitted from theory. Substitution and complementary relationships among commodities are not given by the objective characteristics of the commodities but are rooted in the specific utility function of each individual consumer and are therefore expected to be different for different consumers. Therefore, nothing can be said about such relationships on an *a priori* basis.

(d) The traditional theory does not handle explanations of changes in consumer tastes, except as shifts in demand functions. To whatever extent income and prices do not explain observed behavior, the explanation rests with variations in consumer tastes. However, the traditional theory which the empirical researcher utilizes is unable to assist him in choosing the appropriate taste proxies on a priori grounds or in formulating predictions about the effects of these variables on consumer behavior.

The Household Economics Theory

The household approach enables us to deal with nonmarket or noneconomic factors that affect consumer behavior. Schuh [31] emphasized that recent extensions of economic theory would enable us to deal both with conventional economic variables such as income and prices, and with nonconventional aspects of behavior such as fertility, marriage, divorce, race, sex, schooling, and health. The new contribution to the theory provides basically an economic theory of the family or, as it has been called, the "New Household Economics Theory." According to Schuh, the new theory has three essential ingredients that distinguish it from the traditional theory.

(a) It views the household essentially as a firm or factory with the result that neoclassical theory of the firm enables us to understand what takes place within the household. The traditional theory, on the other hand, explains the activities of the household in relation

to its market activities

(b) The important variable "time" is brought explicitly within the scope of economic analysis, largely by recognizing that individuals seldom consume only a market good, but consume some combination of that market good and some limited time available

(c) The new theory attempts to help explain nonmarket activities that have to do with schooling, investments in health, marriage, and household size, to name a few.

Unlike the traditional approach, the new theory implies that the direct consumption of goods is not the goal of the consumer, but is the means of obtaining more basic needs, such as nutrition in the case of food consumption, which become the real source of satisfaction [5] Lancaster's [18] and Becker's [5] new approach is predicated in the argument that goods per se are not the direct objects of utility, instead, they are the means to the final desire or satisfaction

Lancaster's Consumer Goods Characteristics Approach

In Lancaster's approach to consumer theory [22], the utility function is defined in characteristics space, rather than in goods space. In the traditional theory, goods which are easily quantifiable are assumed to be the direct source of utility or satisfaction for the consumer. According to Lancaster's theory, the assumption is that consumption is an activity in which goods are inputs, and in which the output is a collection of characteristics which become the arguments of the utility function. A single good can have more than one characteristic, providing multiple outputs from the consumption of a single good. Goods in combination may

also possess characteristics [redacted] pertaining to the goods separately

Lancaster used the following model which allows a more general multidimensional function:

Maximise U(z)

Subject to $p'x \leq m$

$z = Bx$

$z, x \geq 0$

Where U is utility operating on characteristic space (C-space) and z is a vector of characteristics The budget constraint $p'x \leq m$ is defined on goods space (G-space), where x represents quantity of goods, p the price vector and m is income, $z = Bx$ represents a transformation between G-space and C-space The matrix B, which is called the consumption technology, represents qualitative properties of the goods, $z = Bx$ is linear, and B is a matrix of constants The following important assumptions are made to obtain a viable model for the optimization problem

(a) Objectivity - All the relationships and the equations are assumed to hold for all individuals The intrinsic properties of the goods, and possibly the context of technological knowledge in the society are known.

(b) Each consumption activity produces a fixed vector of characteristics, and that relationship is linear, i e , r characteristics are related to n consumer goods (n > r usually) by a linear fixed technology matrix $B = (b_{ij})$, where b_{ij} is the amount of the i^{th} characteristic in one unit of the j^{th} good i = 1, 2, ... n Linearity

is assumed to simplify the problem without loss of generality

(c) The consumer possesses an ordinal utility function on characteristics U(z) and that he(she) will choose a situation which maximizes U(z).

Lancaster's new consumer theory has been very useful in dealing empirically with consumer durable goods and assets, new commodities, and quality-differentiated products. The effects of product changes, advertising, and innovation in consumer goods can be analyzed in the framework of the new theory, since the consumption technology, and not the utility function, is expected to be affected by these factors. In the new model, a new product simply means addition of one or more activities via consumption technology. Traditional theory has limitations in dealing with these factors.

Becker's New Approach

Becker's Theory of Allocation of Time and Household Production Function Approach [5] has been helpful to empirical studies regarding household economics. His theory has been applied to a wide range of household problems such as fertility, marriage, population growth, and investments in children.

Becker's new consumer theory rests on the assumption that utility is obtained from commodities which are produced by the consumer unit itself through the productive activity of combined purchased market goods and services with some of the household's own time. Goods and services purchased through the market system are considered inputs and the commodity produced through the productive system is the final

output, which is the argument of the utility function

Becker's household utility maximizating model is expressed as

Maximize $U = u(z_1, z_2, \cdots z_n)$

Subject to $z_i = f(x_i, t_i)$, and the income constraint,

$$M = \sum_{i=1}^{n} p_i x_i$$ and a constraint on the household's available time

$$T = t_w + \sum_{i=1}^{n} t_i$$

where z_i represents quantity of commodity i produced by the household using a vector of market goods x_i, and a vector of quantities of its own time, t_i. p_i and x_i are the price and quantity of the market good input used in producing z_i, respectively. t_w and t_i are the household's time spent in the labor market and in producing z_i, respectively

The time and money income constraints were combined into a single resource constraint on the household's "full income," $S = wT + V = \sum_i (wt_i + p_i x_i)$, where w is the wage rate and V is the household's nonwage income. The utility function, therefore, is maximized subject to the constraints of the production function [$z_i = f(x_i, t_i)$] and resource constraint

$S = \sum_i (wt_i + p_i x_i)$ The Lagrangian function is expressed as

$$L = U(z_1, z_2, \cdots z_n) - [\sum_i (wt_i + p_i x_i) - S]$$

The household production function framework gives emphasis to the parallel services performed by firms and households as organizational units. The neoclassical theory of the firm can easily be applied to household economics. Like a firm, a household unit maximizes its objective function, subject to resource and technological constraints, including labor and capital. The new approach incorporates numerous

nonecoonomic variables into the consumer demand function. This is accomplished by expanding the economist's theory of choice into the nonmarket sector, thereby making the theory more applicable to the new household economics. The approach has been a stimulant to numerous empirical studies such as the production theory of family health, children, marriage and schooling. An example in which Becker's production function approach would be applicable is in the production of family health. Here, the output can be measured in terms of nutrient values and the inputs conceived as variables are food consumption and other macroeconomic factors that affect the production - consumption process. For instance the level of education or employment can be introduced as an input in the family health production function.

Bagali's Nutritional and Nonnutritional Components of Demand for Food

Bagali [3] used a model which decomposes the food demand vector into nutritional (biogenic), and nonnutritional (social and psychogenic) components within a framework of the traditional consumer approach. The major objective of Bagali's empirical study was to develop a method for measuring nutritional and nonnutritional components of demand for meat products. Results of this study supported the hypotheses that: (a) nutritional inefficiency exists, (b) nutritional and nonnutritional components are competitive, and (c) increased food expenditures augment the influence of nonnutritional factors. The result also showed that higher income or food expenditure does not necessarily lead to nutritional improvement. The study suggested that normal foods that are nonnutritionally inferior are underconsumed.

According to Bagali, food purchasing behavior can be explained neither by traditional theory nor by the new approach. His argument lies on the assumption that Lancaster's objective characteristics do not appear in traditional theory. As such, nutritional factors could not be handled by traditional consumer demand theory. Conversely, the new household theory could handle objective characteristics (nutritional requirements) but not the nonnutritional factors which are inherently subjective. In other words, there is no place for objective characteristics in the traditional theory. His model was an attempt to integrate objective (nutritional) and subjective (nonnutritional) characteristics into consumption analysis.

In Bagali's study, household characteristics are the argument of the utility function since they explain consumers food purchasing behavior. According to Bagali, consumption of food serves the purpose of satisfying two basic needs, biogenic (nutritional) and psychogenic (nonnutritional).

The nutritional need is self explanatory, in the sense that it has an effect on the physical growth and mental development of an individual. The nonnutritional component, on the other hand, has historically been either unrecognized or discounted in consumer demand theory. Bagali argues that nonnutritional factors affecting the demand for food can be categorized as religious, cultural, social, psychological, economic and sensory [3]. In many societies, food habits are associated with religion. Certain religious and ethnic groups do not eat pork or beef while some others are vegetarians. The cultural habits of preparing and consuming food differs by ethnicity, sex, age and geographical area. Other social factors that influence the demand for food are education and employment

status of the homemaker (mother) and the composition and size of the household. Therefore, religious, cultural and other social characteristics must be incorporated into empirical analyses of consumer behavior.

The other major factor that influences the demand for food is economic status or the household. Economic conditions influence food choices very strongly. The purchasing power of the household is a major determinant in the quantity and quality of diets. Income and property ownership of the household are the two major yardsticks of measuring the economic status of the household.

Conceptual Framework of the Present Study

This section discusses how traditional consumer theory, the new household economics approach, and the nutritional and nonnutritional approach are applied for the present study.

Traditional consumer theory generally ignores household characteristics, such as ethnic background, social class, family size, and residential location of the household, in determining the variations in food consumption habits between households of different social and economic strata. This study attempts to include relevant household characteristics in the general neoclassical model that describes the Engel relationship with no deviation from the basic consumption theory. This modification on the Engel curve can easily be applied in empirical studies.

Extensive research has been done to modify the general Engel curve[6],

[6] The Engel curve is the relationship between expenditures on a given commodity and the income of the household for a specified period of time.

due to the fact that the traditional consumption theory lacks applicability to available data and empirical research. Allen and Bowley [2], Prais and Houthakker [27], Lancaster [18], Becker [5], and Philips [26] have identified other factors, not included in the traditional model, that effect the household's consumption habits and decisions.

In line with the above theoretical background, this study views the household as one organizational unit. Within this framework the following household optimization model is used to explain the interrelationship between nutritional status, socioeconomic characteristics, and food expenditure of the household:

Maximize $U = u(z)$ subject to resource (total income) constraint,

$Y = c(p, w, z, k)$

where z is vector of nutrients (characteristics),

u is utility,

c is cost function,

$Y = pq + wl_a$ money income plus time (leisure) income,

p is vector of prices of q,

q is vector of market products,

l_a is vector of labor inputs, utilized within the household process,

w is vector of wage rates,

k is capital items (technology set).

Using Philips [26, pp, 27-31] explanation on duality relation, the above direct utility function can be altered to an indirect utility function by substituting optimal quantities p^*, w^*, z^*, for p, w, z in $c(p,w,z,k)$. This transfer leads into equations stated as the minimization of the cost function with respect to price, income, wage rate

and nutrient, given the respective quantities. By minimizing the cost function, the following demand system is obtained by using the Lagrange Multiplier, and first and second order conditions:

$$q_i = \frac{\partial c}{\partial p_i} = q_i\ (p,w,z,k,) \rightarrow \text{demand for } i^{th} \text{ type of expenditure,}$$

$$l_{or} = \frac{\partial c}{\partial w_r} = l_{or}(p,w,z,k) \rightarrow \text{demand for } r^{th} \text{ type of labor,}$$

$$q_j = \frac{\partial c}{\partial z_j} = q_j(p,w,z,k) \rightarrow \text{shadow price of } j^{th} \text{ nutrient (characteristic)}$$

Restating the problem, the household nutrient optimization problem is written as:

$$\text{Maximize } U = u(z) \qquad (1)$$

subject to

$$Y = \sum_j q_j(p,w,z^*,k)\ z_j$$

where q_j are the shadow prices at the optimal levels of z, z^*. The above constrained maximization yields the following structural equation for Z_j

$$Z_j = z_j\ (y, q) \qquad (2)$$

The above structural form (2) can be reduced into equations of the following form

$$Z_j = s_j\ (y,p,w,k) \qquad (3)$$

$$q_i = q_i\ (y,p,w,k) \qquad (4)$$

Equations (3) and (4) are solutions of the corresponding structural forms that contain the demand functions. These reduced forms are used as the basis for this empirical study. Reduced form (3) is used to define the nutrient household characteristics relationship while reduced

Form (3) is used to describe the food expenditure socioeconomic characteristics relationship.

CHAPTER IV
EMPIRICAL FRAMEWORK

Empirical Model

The objective of this study is to measure the impact of socio-economic characteristics on household food expenditure. In this study, the only variable assumed to be constant is the goods prices. Prices are assumed constant, since cross-sectional data are used and all households would face the same prices. The approaches of Lancaster's household characteristics [18], Becker's production function [5], and Bagali's nonnutritional consideration [3] are used to determine the impacts of socioeconomic characteristics on food expenditure and nutritional status. Theoretical models, equations (3) and (4), are the bases of this cross-sectional study. Following the above theoretical models, the empirical models of this study are expressed as

$$Q_f = f(I, FSP, HS, A, E, L, S) \qquad (5)$$

$$N_j = f(I, FSP, HS, A, E, L, S, V) \qquad (6)$$

Where Q_f is the household's monthly expenditure on food,

N_j is the value indicating nutrient levels (j = 1, ..., 8)

I is the average monthly income of the household,

FSP reflects participation of one or more members of the household in the Food Stamp Program,

HS measures the number of persons in the household,

A is the age of the homemaker,

E reflects the ethnic background of the household,

L denotes the residential location of the household,

S reflects the social class of the household, in terms of the occupational status and educational level of the homemaker,

V reflects if the household has vegetable garden (technology set)

The above relationships expressed in equations (5) and (6) are in line with the theoretical model a_f, $q_f = f(y,p,w,k)$. Variables I and FSP explain the economic condition of the household. Variable HS was included in the model to capture the effect of economies of size in food purchasing and nutrient intake. Variable L indicates the proximity to markets and captures the cost of living effect of regional differences.

It was hypothesized that the household's food consumption behavior is related to the household's tastes and preferences. It is, therefore, assumed that tastes and preferences are determined by ethnic background, educational level, and occupational status of the homemaker. For this reason, variables A, E and S were included in the model to determine the effect of tastes and preferences, which are likely to differ among households of different social strata. In the nutrient model, variable V is included as a capital item to denote the presence of a vegetable garden. The explanatory variables that explicitly incorporate the socioeconomic characteristic of the household are explained in greater detail in the succeeding section.

Independent Variables

As stated in the preceding equation, the households food consumption behavior and nutrient intake are influenced by socioeconomic characteristics, subdivided into economic and noneconomic factors

Economic Factors

Income. The economic condition of the household is a major determinant of the household's food expenditure. The quality and quantity of food purchased mainly depend on the purchasing power of the household [9, 19, 24, 25, 30, 39]. Income and price levels are major components of purchasing power which is the major economic component of the household food expenditure. In both the traditional consumer theory and the household economics approach, income and price are key variables in determining food consumption behavior. In this study these two economic variables are also assumed to be major determinants of food consumption behavior. However, since this study uses cross-sectional data, food prices are assumed to be the same for all households.

Food Supplement Income Transfer. This variable is also one of the economic factors that determine the value of food expenditure. Results of empirical studies [1, 14, 19, 22, 39] suggests that there is a direct relationship between FSP bonus income and food expenditures. Davis and Neenan [14] found that participation in FSP increased household discretionary income, which impacted positively on food expenditure and nutrient intakes. FSP participation will therefore be evaluated as a variable affecting food expenditure and nutrient levels.

Noneconomic Factors

The noneconomic variables discussed here are largely associated with Bengali's nonnutritional factors [3]. The following characteristics are hypothesized to be the major factors influencing food purchase and nutrient consumption. Most of these noneconomic factors are included in the empirical model to account for difference in tastes and preferences.

Family Size. The number of persons in a household is expected to affect the value of food expenditures [25]. There might even be

economies of scale since family packaged food items tend to be less expensive than small size packaged food items. Most often, there are price discounts when large quantities of food are purchased. This study will attempt to assess changes in household food expenditure and nutrient levels associated with size of households.

Educational Level. Educational level of the homemaker is assumed to be a source of information about health and nutrition. Persons with higher levels of schooling are more inclined to scrutinize the product contents of packaged foods for nutrient values. Sweetre and Jensen [30] found a positive relationship between the level of education of the female homemaker and nutritional status of the household. The mother or guardian of the household in which the adolescent resides is assumed to be the homemaker. As such, it is expected that the educational level of this homemaker will influence food expenditure and adolescent nutrient levels.

Residence. Residential location of a household is another factor that is expected to affect consumption and nutritional status of households [19]. Urban residents may benefit from the availability of a wider choice of supermarkets and grocery stores, which would make possible a greater variety of food items and choice in prices, quality, and quantity of food items. Conversely, some rural households grow garden vegetables which are excellent sources of essential nutrients. The extent to which residential location influence food expenditure and nutrient status will be analyzed.

Ethnicity. Culture, ethnic customs and traditions are factors which help to explain food consumption behavior [3, 14, 19, 25, 30]. People of different ethnic and racial backgrounds tend to prefer one kind of food

item to another These consumption habits have an impact on the nutritional status of households

Nutrition Education Program. Nutrition education programs, such as the Expanded Food and Nutrition Program (EFNEP) have been found to be a major determinant of food expenditure and nutrient intake of low income households [14] The objective of this particular program is to help low income households acquire knowledge about nutrition, food economy and meal planning and preparation

Employment Status of Homemaker The employment status of the homemaker is also one of the factors responsible for variation in food consumption habits and nutrient status of the household [25] For homemakers employed outside the home there is a time constraint on food preparation at home In this situation, one of the following could happen (a) partly cooked or frozen food items are purchased so that the homemaker takes less time to prepare home-cooked food, (b) food might be consumed away from home, such as school, fast food restaurants, etc This consumption behavior will have an impact on the value of food expenditures and nutritional status of the adolescent.

Age of the Homemaker Younger families, particularly those with children, tend to place a higher emphasis on food and nutrition than do older families [22] The type of food consumed will have an impact both on the value of food expenditure and on nutritional status of the adolescent

Hypotheses

The federal government's income transfer programs were designed to improve the nutritional status of poor people. Although increased income transfers tend to increase the purchasing power of low income households, there is still no consensus with respect to whether or not these programs resulted in improving the diet of poor people. This study will attempt to answer some of the questions raised earlier by testing the following hypotheses.

(a) The economic condition of the household is a major determinant of variations in food expenditures. Increased income and participation in the Food Stamp Program (FSP) will have a positive impact on the value of food expenditure.

(b) Families with large numbers of people in the household spend more on food than small size households. However, the value of food expenditure per person decreases as the size of the household increases.

(c) Educational level and employment status of the homemaker will impact positively on the value of food expenditure. No *a priori* hypothesis is given as to how the homemaker's employment status is going to effect the nutritional status of the adolescent. The general educational level of the homemaker alone will not have a beneficial effect on the dietary level of the family. Special educational programs, particularly, the Expanded Food and Nutrition Education Program (EFNEP) will have a positive influence on the nutrient intake of the adolescent. The FSP

Program without EFNEP will have a lesser effect.

(d) Age of the homemaker will have a negative relationship on both the value of food expenditure and nutrient intake. Older people tend to have difficulty in overcoming traditional food patterns and generally place less emphasis on nutritious food than do younger people.

(e) Generally, rural households who have less access to diverse types of food stores are more malnourished than urban dwellers. The difference of malnourishment between the two regions is expected to be minimum since rural households tend to consume more fresh food items (such as garden vegetables) than do urban dwellers.

(f) No a priori hypothesis is given with respect to differences in sex as associated with variations in food consumption behavior and levels of nutrient intakes.

(g) Generally, ethnic groups who have easy access to occupational, educational and economic opportunities have a better diet than other groups. To this effect, it is hypothesized that whites are less malnourished than blacks and hispanics.

Test results of the above hypotheses not only explain socioeconomic impacts on food consumption behavior and nutritional status of the adolescent but also help in discussing food and nutrition policy formulations and implementations.

Data Base

Sample survey instruments were used to generate nutritional and socioeconomic parameters for adolescents from low income households

Urban samples were obtained from the inner-city area of the city of Miami, and rural samples were taken from Sumter County in north central Florida, over the 1979-1980 period

The inhabitants of the inner city area of Miami are predominantly low-income blacks. This region's population is thought to be representative of other poor minority households in Florida. Sumter County, on the other hand, is predominantly rural with no town with a population greater than 2500. The estimated population of the county in 1977 was 21,586. The per capita income of this county in 1977 was $4,433, which is low compared to the state ($6,728) and national ($7,019) average [8]

The total adolescent sample consisted of 381 subjects - 202 from urban Miami and 179 from rural Sumter County. Two schools from each area were selected, and a stratified random sample of adolescents (age 12-16) were selected from each school. Each adolescent received a complete physical examination by the survey team physician. Fasting blood samples were taken by venipuncture for analysis of nutrient indicators. These nutrient indicators are the dependent variables in the nutrient level model. The indicators included values for serum and red blood cell folacin, serum iron, total protein, hemoglobin, vitamin C, vitamin B_{12}, and hair zinc. The samples were stratified by poverty level, sex, and ethnic group, and contained a larger number of blacks than would have been obtained by a random sample of the state's population.

The individual adolescent is the unit of observation for the biochemical nutrient indicators. However, for purposes of explaining the impact of socioeconomic factors on adolescent nutrient indicators, sample survey data were obtained via a separate survey instrument

(Appendix E) administered to the household units to which the adolescents belong. The total household sample consisted of 305 units - 157 from the Miami area and 148 from Sumter County. The socioeconomic characteristics of these households are used as explanatory (independent) variables against the adolescent levels of nutritional indicators in the operational models.

Functional Form: Statistical Model Specification

The type of functional form to be selected largely depends on the type of empirical problem and the type of the data collected for the study. In choosing the functional form the theoretical plausibility of the demand equations should be ensured. Several studies used different functional forms to estimate household expenditure models. Allen and Bowley [2] used a linear functional relationship to estimate Engel curves. Prais and Houthakker [27] tried linear and non-linear relationships to generate improved estimates. They suggested that semi-logarithmic and double-logarithmic functions give better results to estimate food expenditure and other household expenditure, respectively. Salathe and Buse [32] suggested a quadratic function in which food expenditure is a function of income squared and the square of household size. Phlips questioned the extent to which the type of functional forms discussed above are theoretically plausible. He discussed the trade-off between statistical (pragmatic) results and properties of economic theory. He addressed the need for further research to find functional forms that are both realistic and theoretically plausible.

Food Expenditure Functional Form

For this study, a double-logarithmic functional form would be the

appropriate model to explain variation in food expenditure resulting from variation in the household's socioeconomic characteristics. This functional form satisfies the conditions of the Engel curve which is convex to the origin, satisfies the adding-up condition through a transformation technique (intrinsically linear), and has a positive intercept to avoid a possibility of negative expenditure values [26]

Studies reviewed earlier also indicate that food expenditures vary nonlinearly with income and family size and levels off as these explanatory variables reach a certain limit. Following these arguments, the statistical model that describes the relationship between food expenditure and socioeconomic characteristics is specified as:

$$luQ_f = a+B_1 lnI+B_2 lnHS+B_3 FSP_1+B_4 A_1+B_5 E_1+B_6 E_2+B_7 R_1+B_8 R_2+B_9 L_1+B_{10} EMP_1 + B_{11} EDNT_1+U_t \quad (7)$$

where luQ_f = log of household's monthly food expenditure in dollars

lnI = log of household's monthly income (from all sources) in dollars

lnHS = log of household size-total number of individuals in the household who depend on a common pool of income

FSP = Participation in the Food Stamp Program (FSP_1 = 1 if one or more members of the household received food stamps)

A = Age of the homemaker (A_1 = 1 if age is greater than 40)

E = Educational attainment of the homemaker

E_0 = 1 if school grade is greater than 12

E_1 = 1 if school grade is 9-12

E_2 = 1 if school grade is less than 9

R = Ethnic background of the household

R_0 = 1 if hispanic

R_1 = 1 if white

B_i = 1 if black

[illegible] = [illegible]tial location of the [illegible]

R_1 = 1 if rural (Sumter)

U_1 = 1 if urban (Miami)

EMP = Employment status of the homemaker (EMP_1 = 1 if employed, 0 otherwise)

EDNT = Nutritional education of the homemaker ($EDNT_1$ = 1 if homemaker has basic nutritional education, 0 otherwise)

U_t = Error term assumed to be distributed normally with zero mean and constant variance.

Zero-one dummy variables are used to analyze the impact of all explanatory variables, with the exception of income and family size. Log of family size is included to allow economies of size for food expenditures. The initial categories (0 subscripts) of the dummy variables are omitted to avoid problems of perfect multicollinearity (singularity). Specifically, the excluded 0 subscript variables whose coefficients will be picked up by the intercept are, FSP_0, A_0, E_0, K_0, L_0, EMP_0, and $EDNT_0$, representing nonparticipation in FSP, less than 40 years old, college level education, hispanic origin, rural household, non-employed and no basic nutritional education, respectively.

Biochemical Nutrient Functional Form

Lancaster's characteristics approach to demand theory [18] is used as a theoretical basis for estimating the relationship between nutrient values and socioeconomic variables. Within this framework, food expenditures, per se, are not the arguments of the utility function. Rather, it is the nutrient value of food consumed which provides satisfaction to an individual. Thus, following Lancaster, Becker, and Sagaii, food expenditure is a behavior characteristic which satisfies biogenic

nutritional) need. Therefore, values of nutrient indicators are expressed as a function of socioeconomic variables, including income.

As to the appropriate type of functional form for the nutrient model, no substantial study has been done to define the nutrient - socioeconomic relationship. For this reason, this study did preliminary experimentation with different functional forms. The preliminary finding showed that the linear model produced a better estimate in describing the nutrient - socioeconomic relationship. This study, therefore, uses a linear OLS regression model to estimate the impacts of household socioeconomic characteristics on the nutritional status of the adolescent.

Writing the above reduced forms into statistical functional form, the following linear regression is to be estimated by OLS.

$$N_j = \alpha+\beta_1 I+\beta_2 HS+\beta_3 FSP_1+\beta_4 A_1+\beta_5 E_1+\beta_6 E_2+\beta_7 R_1+\beta_8 R_2+\beta_9 L_1+\beta_{10} EMP_1+$$
$$\beta_{11} S_1+\beta_{12} V_1+U_t \qquad (8)$$

where N_j = The biochemical nutrient indicator of the j^{th} nutrient representing $j = 1,2,\ldots 8$.

1 = Serum Folacin (SF)

2 = Serum Iron (IR)

3 = Red Blood Cell Folacin (RE)

4 = Hemoglobin (HGB)

5 = Total Protein (PRTN)

6 = Vitamin C (VITC)

7 = Vitamin B_{12} ($VITB_{12}$)

8 = Hair Zinc (HAIRZN)

S = Sex of the adolescent
(S_1 = 1 if adolescent is male, 0 if female)

[illegible] old has vegetable garden
(D_1 = if household has vegetable garden, 0 otherwise)

I = Household's monthly income (from all sources)

HS = Household size

The notations for the other independent variables are explained in the expenditure model

Although each nutrient may be affected differently by various factors, the same socioeconomic relationship is used for each nutrient. There is no justifiable reason to modify the model or to delete or include variables for any one nutrient. The physiological function of, and problems associated with deficiency of these nutrient indicators are given in Appendix Table C

CHAPTER V
EMPIRICAL ANALYSIS -- SOCIOECONOMIC COMPONENT

In this chapter the empirical results of the socioeconomic component of the study are presented. The discussion of the findings are presented in two parts. The first part is a descriptive analysis of the socioeconomic and demographic characteristics of the households. A discussion of the incidence of poverty and the distribution of total household expenditure by type of household group are presented in this section. In the second part the findings of the selected OLS regression analyses of the food expenditure model are discussed. The impact of selected socioeconomic variables on the value of household food expenditure is analyzed. The marginal propensities and food expenditure-income elasticities for all families in each household category are presented also.

Descriptive Analysis

Household Income and Poverty Characteristics

Table 6 presents the mean level of selected socioeconomic variables, including average household income by race and region for all households sampled. The average monthly income for the entire sample population (303 households) was $887 per household. There was an average of 4.78 persons per household, which translated into an average monthly income of $186 per person. Disaggregation of the data by race and region shows rural white households accounting for the highest group level income. They reported an average monthly income of $1154 per house-

Table 6.--Summary of mean household values, selected socioeconomic variables, Miami and Sumter County, Florida, 1980

Socioeconomic variable	Call count (n)	Total n=305	Household category: Urban (Miami) Black n=128	Urban (Miami) Hispanic n=24	Rural (Sumter) Black n=48	Rural (Sumter) White n=100
			---Dollars---			
Monthly income	303	887 00 (37.7)[a]	881 00 (54.1)	600 00 (57 8)	493 00 (36 5)	1154 00 (80 1)
Monthly food exp	304	254 00 (6 97)	224 00 (9 7)	262 00 (26 6)	237 00 (13 5)	294 00 (13 7)
Total monthly exp	303	646 00 (16 91)	584 00 (20 9)	637 00 (54 4)	528 00 (37 1)	781 00 (34 3)
			---Numbers---			
Household size	305	4.78 (0.10)	4 82 (0 17)	4 83 (0 40)	5.15 (0 29)	4 50 (0 12)
Age (homemaker)	305	41 2 (0 52)	42 1 (0.89)	41 3 (1 74)	42.6 (1 50)	39 7 (0 70)
Educational level (homemaker)	276	11.2 (0 10)	11 6 (0.24)	6.9 (0.88)	11 2 (0.20)	11 8 (0 20)
			---Percent---			
<9th grade		12 0 (1 96)	10.2 (2.92)	65 0 (10 94)	4.6 (3 18)	5.1 (2 23)

Table 6 -continued.

9-12th grade		72.1 (2.78)	68.5 (4.49)	30.0 (10.51)	88.6 (6.84)	78.6 (4.17)
>12th grade		15.9 (2.21)	21.3 (3.96)	5.0 (5.00)	6.8 (3.84)	16.3 (3.75)
Employment (homemaker)	279	68.1 (2.80)	75.5 (4.12)	40.9 (10.73)	60.5 (7.54)	69.1 (4.71)
FSP participation	277	28.0 (2.70)	33.0 (4.53)	36.4 (10.50)	53.7 (7.88)	9.1 (2.90)
Nutritional education (homemaker)	279	41.0 (2.95)	62.7 (4.63)	78.3 (8.79)	16.7 (5.82)	16.3 (3.75)
Marital status (married)	305	65.0 (2.72)	55.5 (4.41)	75.0 (9.02)	47.0 (7.20)	85.0 (3.59)
Vegetable garden	295	18.6 (2.27)	9.9 (2.72)	9.1 (6.27)	17.4 (5.65)	33.3 (4.76)
EFNEP Participation	278	9.7 (1.78)	8.1 (2.00)	4.6 (4.54)	7.1 (4.02)	3.3 (3.44)

[a]Numbers in parentheses are standard errors of mean

held ($256 per person) Rural blacks reported the lowest level of income, with an average monthly household income of $493 ($96 per person) Cuban Americans (hispanics) had an average income of $600 per household ($124 per person).

Among rural households, the average income for a white person was about 2 7 times the average income of a black person ($256 versus $96). Further indication of the income gap between groups of households is reflected in Table 7, which shows the estimated distribution of income below and above the national poverty income levels The numbers shown in Table 7 are calculated by dividing the annual income of the household by the corresponding poverty threshold of the 1980 Federal Register's Poverty Income Guidelines [15] The guidelines reports the poverty threshold for every family size and family type (Appendix A).

The incidence of poverty (percentage of families below the poverty threshold) was highest among rural black households and lowest among rural white households. As shown in Table 7, 53 percent of rural black households were below the threshold Of this number, 56 percent could be classified as being chronically poor. Also 67 percent of rural white households could be classified as "less poor", since their average income was greater than 125 percent of the threshold Only 4 percent of the rural black households reported an income level above 125 percent of threshold level.

Among urban households, the incidence of poverty was highest in the hispanic group (Table 7) Sixty-two percent of hispanic households registered an average income below the poverty income level Of this number, 46 percent were below 75 percent of the threshold. The prevalence of poverty for urban blacks was 43 percent, of which 23 percent could

be classified as chronically poor. Also, 41 percent of urban black households could be classified as being 'less poor', since their level of income was greater than 125 percent of the poverty threshold. Only 17 percent of the hispanic households were estimated to be in the "less poor" category. The incidence of poverty in Florida families was estimated to be 10 percent for whites, 38 percent for blacks and 18 percent for hispanics [8, p. 136]. The findings of this study, therefore, show a higher estimated incidence of poverty in all ethnic groups than that reported by official sources [8]. There are at least two possible explanations for the higher poverty incidence found in this study. First, this study used a more recent poverty income guideline than the official sources. The more recent guidelines are adjusted to account for inflationary changes. Second, the households and regions selected for this study were selected on the basis of observable low income characteristics. It is, therefore, expected that the incidence of poverty for these households would be somewhat greater than the state average.

Household Size and Other Sociodemographic Characteristics

The size of the household plays an important role in determining the value of food expenditure [25]. In this study, 305 households responded to the socioeconomic questionnaire and all reported the number of persons living in the household. The average household size for the total sample was 4.78. Among ethnic groups, rural whites reported an average family size of 4.50, while the average size for rural blacks was 5.15. There was no significant variation among urban households. Urban blacks had an average of 4.82 persons per household compared to 4.83 for hispanics (Table 6).

Table 7.--Estimated poverty incidence among households, by race and location, Florida, 1980[a]

Race/Residence	Cell count (n)	Poverty thresholds: <75% of poverty level	75-100% of poverty level	100-125% of poverty level	>125% of poverty level
		Percent			
Urban:					
Black	128	22.6	20.2	16.0	41.1
Hispanic	24	45.8	16.7	20.8	16.7
Rural:					
Black	48	56.3	27.1	12.5	4.1
White	100	21.0	4.0	8.0	67.1

[a]For Poverty Income Guidelines, see Appendix A.

Table 8 --Family size distribution among households by race and location, Florida, 1980.

Race/Residence	Cell count (n)	Family size: 2-4	5-7	>7
Urban:				
Black	128	49.2	45.3	5.5
Hispanic	24	45.8	50.0	4.2
Rural:				
Black	48	41.7	47.9	10.4
White	100	52.0	46.0	2.0

[illegible] distributions of family size by race and residents is presented in Table 8. Forty nine percent of urban black households registered 2 to 4 persons per household. The corresponding figure for hispanics was 46 percent. Rural black and rural white households reported 42 percent and 52 percent, respectively, for the same family size group (2 to 4 persons). One half of the hispanic group responded that the number of persons living in the household was in the range of five to seven. Forty-five percent of urban blacks, 48 percent of rural blacks and 46 percent of rural whites reported the same number of persons (5 to 7) in the household. Ten percent of rural blacks reported the number of persons in the household as greater than seven. The corresponding figures for the other sample groups were much lower (Table 8).

There are a number of problems encountered in generating social survey data that are absent in other surveys. Many such problems are associated with the complex social psychology of the human subject in this study, one such problem existed with the accuracy of household income and expenditures. Households have a tendency to underreport income and overreport expenditures. This general tendency is reflected in Table 6, where hispanics reported mean total household expenditure higher than their total income, by an average of $37. The same was true for rural black households, who registered that the mean total expenditure was greater than mean total income by an average of $35. These apparent inconsistencies could be the result of subjectivity in data reporting, as indicated earlier, or it could be related to the fact that savings, investments and credit might have been used for current expenditures. The latter might have been especially true for some of

[illegible] Cuban Americans who might have been able to emigrate with some type of assets in the past

The average educational level for urban hispanic mothers (homemakers) was only 6.9 years of schooling, compared to 11.6, 11.2 and 11.8 for urban blacks, rural blacks and rural whites, respectively (Table 6). Employment-wise, the lowest employment rate was registered among hispanic homemakers. Forty one percent of hispanic homemakers reported that they were working outside the home. In contrast, the employment rate for urban black homemakers was about 76 percent. The corresponding percentages for rural blacks and rural whites were 61 percent and 59 percent, respectively (Table 6).

Twenty eight percent of the sample population participated in the Food Stamp Program (FSP). Among urban ethnic groups, 33 percent of black households and 36 percent of hispanic households responded that one or more members of the household participated in the FSP. Among rural black households, 54 percent were registered FSP participants compared to only 9 percent among rural white households (Table 6). This result is not surprising, since 83 percent of the rural black households were classified as poor compared to 25 percent among their white counterparts (Table 7).

Conceptually, the basic nutritional education level of the homemaker (mother) was hypothesized to play a significant role in affecting the nutritional status of the adolescent. Also, nutritional education is one of the socioeconomic variables postulated to have an influence on the value of food expenditure. Specifically, this variable is conceived as affecting the efficiency of food procurement, food storage, and meal preparation. The specific nature of the current and

ood expenditure responses to this variable are discussed in the regression analysis sections. However, from a wider sociodemographic viewpoint, the distribution of nutritional education among household groups appears to be a logical starting point for further analysis of this variable. From the data it would appear that urban homemakers had a relative advantage in this regard. Specifically, 63 percent of urban black households, and 78 percent of urban Hispanic households indicated that they had some knowledge of diet, food and nutrition requirements as a result of some type of nutrition education programs. In contrast, the corresponding figures for rural blacks and rural whites were only 17 percent and 16 percent, respectively (Table 6). Of some interest is the fact that Expanded Food and Food and Nutrition Education Program (EFNEP) participation was minimal in each of the groups (Table 6). Thus, most of the households might have obtained nutritional education from other sources, such as news media, pamphlets, books, friends, physicians, and extension agents who were not directly involved in EFNEP. It should be noted, also, that the relatively lower level of participation in EFNEP among rural households might have been related to the non-availability of the program in the particular rural area surveyed.[7]

It was felt that a vegetable garden might make a difference in the nutritional status of the adolescent. For this reason, one of the questions asked was whether or not the household had a vegetable garden

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[7]The EFNEP was not operational in rural Sumter county at the time of the survey. Households registering participation in the program did so in some other location at a prior date.

during any period of the growing season. Thirty three percent of rural whites, 17 percent of rural blacks, 10 percent of urban blacks, and 9 percent of urban hispanics indicated having vegetable gardens ranging from one to four seasons (Table 6). It was not possible to determine what percentage of the vegetable products were actually consumed or sold. If the greater part of the products grown at home were consumed, rural households would have an advantage and access to some of the nutrients studied. Act, regression results of the nutrient model (equation 8) suggest that a vegetable garden had a minimal role in improving the diet of the adolescent (Chapter VI).

Food Expenditure and Other Household Expenditures

Table 9 presents mean monthly household income and expenditure categories disaggregated on the basis of selected socioeconomic and demographic characteristics. In the aggregate, the largest monthly average expenditure category per household was for food ($254). The next largest expenditure category was for housing ($208). On the average, $87 was spent for transportation, $71 for clothing, $59 for medical care, and $33 for recreational activities. The remainder of monthly expenditures allocations went to tobacco products, alcoholic beverages,and miscellaneous expenses, in that order.

Average monthly household income and expenditure varied substantially across socioeconomic and demographic characteristics of the household. Among racial groups, whites spent more, in absolute dollars, on food, housing, and transportation than the other racial groups. However, in terms of respective income levels, whites spent relatively less on every type of expenditure category except transportation (Table 9). Relatively speaking, average expenditures were proportionally higher

Table 9.--Mean monthly household expenditures by type and selected sociodemographic characteristics, Miami and Sumter County, Florida, 1980

Characteristics	Cell Count (n)	Average monthly income	Food	Housing	Clothing	Medical	Recreation	Transportation	Alcohol	
					dollars					
Aggregate	305	887	254	209	11	59	22	81	[illegible]	[illegible]
Race:										
White	105	1152	295	327	56	62	34	132	[illegible]	[illegible]
Black	126	722	220	190	05	51	34	50	[illegible]	[illegible]
Hispanic	25	590	262	224	47	97	22	58	[illegible]	[illegible]
Location										
Urban	153	930	232	212	70	58	34	5	[illegible]	[illegible]
Rural	150	940	276	206	55	61	22	121	[illegible]	[illegible]
Household size										
2 5 persons	165	952	212	200	51	52	34	85	[illegible]	[illegible]
5 2 persons	142	512	271	216	25	62	30	88	[illegible]	[illegible]
2 persons	16	589	401	222	115	61	55	52	[illegible]	[illegible]
Income										
<25% of poverty level	60	365	225	152	62	55	19	51	[illegible]	[illegible]
25 100% of poverty level	40	565	215	208	79	50	22	69	[illegible]	[illegible]
100 125% of poverty level	42	150	242	201	20	27	21	54	[illegible]	[illegible]
>125% of poverty level	125	1411	292	251	21	55	41	121	[illegible]	[illegible]
Education (homemaker)1										
<9th grade	22	650	248	189	53	15	21	51	[illegible]	[illegible]
9 12th grade	150	853	252	207	21	57	15	86	[illegible]	[illegible]
12th grade	55	1506	282	772	12	59	42	140	[illegible]	[illegible]
Employment (homemaker)										
Employed	100	1002	259	220	71	57	15	96	[illegible]	[illegible]
Unemployed	05	251	204	196	22	67	1	65	[illegible]	[illegible]
FSP										
Participants	72	508	251	121	64	58	[illegible]	[illegible]	[illegible]	[illegible]
Nonparticipants	200	1002	269	226	69	61	[illegible]	[illegible]	[illegible]	[illegible]
Basic nutrition education:										
Yes	114	856	24	2.9	61	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
No	165	939	27	209	71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

for hispanics and rural blacks. In each type of expenditure category, the ratio of expenditure to income was highest in these two racial groups: hispanics and rural blacks (Appendix Table B-1).

Average expenditures also varied substantially by residential location (Table 9). The average monthly expenditure of urban households on housing, clothing, recreation, and alcoholic beverages was higher than those of rural households, both in absolute and relative terms. In contrast, rural households spent more on food and transportation than did urban households. Since there is no local public transportation, rural households generally incur higher transportation costs from use of private transportation. In terms of food expenditure, urban households tend to enjoy a more favorable proximity to markets, which would be expected to provide a wider variety of food items at relatively lower (discounted) prices. Thus, the choice for rural households is one of additional expenditure for transportation to secure a comparable bundle of food items available to urban households (at relatively lower prices), or be satisfied with less and a narrower choice of food items at a relatively higher price.

Rural black households registered the highest percentage of monthly income allocation for food (48 percent of income). In contrast, rural white households spent only 26 percent of their monthly income on food. Comparable allocations for urban black and hispanic households were 25 percent and 44 percent, respectively. Given the average family size of the household categories (Table 6), rural black households had monthly per capita outlay for food equal to $46 compared to $65 for whites. Monthly per capita food outlay for urban black and hispanic households were $46 and $54, respectively. However, given the

significantly higher incidence of poverty among rural black households (Table 7), it might very well be that locational factors might have forced these households to be satisfied with less and narrower choice of food items than their rural white counterparts as well as their urban counterparts. If this were the case, then this could have affected the nutritional status of rural adolescents.

Generally, average household expenditures in each expenditure category of Table 9 were: (a) higher for larger household sizes, (b) higher for households where the homemaker had relatively higher level of education, (c) higher for households where the homemaker was employed outside the home, (d) lower for households in which one or more members of the household participated in FSP, than for households which reported nonparticipation, and (e) higher for households whose average household income was higher than for households with lower average income. Also, households who indicated having no basic nutritional education tended to spend more on food, clothing and transportation. It is conceptually plausible that income, family size, educational level, employment status, and FSP participation are, to some degree, interrelated in their aggregate impact on food expenditure and nutritional status. As such, the net effect of each variable would not be clear from the descriptive analysis. The results of the two regression equations (expenditure model (7), and nutrient model (8)), discussed in the succeeding sections, are used to clarify the impact and relationship of each variable on food expenditure and nutrient level.

As additional background to subsequent analysis, Tables 10 and 11 also summarize the monthly food expenditure of household categories by broad food groups and socioeconomic categories. The largest food group

Table 10.--Mean monthly food expenditure by income and food group category, Miami and Sumter County, Florida, 1980

Food expenditure type	Total	Household category: Urban (Miami) Black	Urban (Miami) Hispanics	Rural (Sumter) Black	Rural (Sumter) White
	n=304	n=128	n=24	n=48	n=100
	Dollars				
Monthly food expenditure	254.00	224.00	262.00	237.00	294.00
	Percent				
Monthly income allocation for food	29.0	25.0	44.0	48.0	25.0
Monthly food expenditure to food groups	Percent				
Meat products	43.0	48.8	44.3	44.2	35.4
Dairy product	16.1	15.1	12.6	16.8	17.6
Fruit and vegetables	18.0	18.2	22.0	14.9	18.2
Grain products	12.9	12.0	16.1	12.2	13.8
Miscellaneous	10.0	6.9	5.0	11.9	15.0
Total	100.0	100.0	100.0	100.0	100.0

Table 11.--Monthly food expenditure as proportion of monthly income, by selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980

Characteristics	Cell count (n)	Mean monthly income	Mean monthly food expenditure	Food expenditure as proportion of income
		----------Dollars----------		Percent
All households	305	887	254	28.6
Race:				
White	105	1143	295	25 8
Black	176	772	228	29 5
Hispanic	24	600	262	43 7
Location				
Urban	159	838	233	27.8
Rural	148	940	276	29.4
Household size:				
2-4 persons	144	853	217	25.4
5-7 persons	142	912	277	30 5
> 7 persons	16	989	401	40 5
Poverty income status:				
<75% of poverty level	88	369	224	60 7
75-100% of poverty level	48	569	215	37.8
100-125% of poverty level	47	750	243	32 4
>125% of poverty level	125	1411	293	20 8
Education of homemaker:				
<9th grade	33	650	248	38 2
9-12th grade	199	853	757	30_1
>12th grade	44	1305	282	21.6
Employment of homemaker:				
Employed	190	1002	259	25.8
Unemployed	89	741	204	27.5
FSP Participation:				
Participant	77	598	251	4? 4
Non-participant	200	1003	265	26 4
Nutrition education:				
Yes	114	866	242	27 9
No	165	939	275	29.3

share went to meat products, followed by fruits and vegetables, dairy products, grain products, and miscellaneous products, in that order. Urban black households spent almost half of their food allocation for meat products (49 percent), while they spent 15 percent of their food expenditure on dairy products. For rural whites, the corresponding shares were 35 percent and 18 percent. Hispanics spent 44 percent of their food expenditure on meat, while the relative share for fruits and vegetables was high compared to other racial groups.

Table 11 shows the proportion of monthly income allocated to food expenditure by selected subgroups. A number of interesting characteristics are evident. Black and hispanic households had food expenditure-income ratios higher than that of all households, while those of whites were lower. The same was true for rural households compared to urban households, five and above person households, compared to 2 to 4 person households, and households with less than 75 percent and 100-125 percent of the 1980 poverty income threshold. Households with income less than 75 percent of the poverty threshold allocated 61 percent of their mean monthly income to food. This percentage was more than twice the average allocation for all households. Households participating in the FSP allocated 49 percent of mean monthly income to food compared to 26 percent for non-participants. The reverse was noted for households with basic nutrition knowledge. In this subgroup, those households with nutritive knowledge had income-food expenditure ratio lower than the aggregate ratio, while those who did not had a higher ratio.

The above descriptive analysis is intended to provide a broad contextual framework for analysis of the econometric results of the expenditure and nutrient models. In reviewing the statistical

(regression) findings. It is imperative that the results be viewed within the broader data set if policy analysis is to be meaningful

Food Expenditure Regression Analysis

The regression results of the food expenditure model (7), which statistically explain the general impact of selected socioeconomic characteristics on the value of household food expenditure, are presented in this section. Specifically, analyses the responsiveness of food expenditure to changes in the level of household income, household size, and other discrete household characteristics, such as race, education status, FSP participation, to name a few are discussed. Detailed model specification for equation (7) is given in Chapter IV. A summary of regression parameters for selected socioeconomic variables for the aggregate sample (total households) are given in Table 12. Summary of regression estimates for the four household categories (race - location groups) are given in Table 13. In Table 14, estimates of marginal propensity to spend (MPS) for food and food expenditure - income elasticity by selected household characteristics are presented

Income Elasticity and Expenditure Propensity Characteristics

Since the set of data for the present study was composed of four distinct race-location groups, it was necessary to test whether the subgroup regressions were significantly different from the aggregate regression. For this purpose, two hypotheses were tested: (a) a test of homogeneity of the regressions in which the intercepts and slopes are hypothesized to be equal for all subgroups, and (b) a

Table 12.--Statistical summary of OLS monthly food expenditure equation[a], all households by selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980.

Socioeconomic variable	Total n=855	Regression coefficient	Standard errors	t-value
Intercept		2.78	0.321	8.69**
Household income (lnI)[a]		0.329	0.044	7.43**
Household size (lnHS)[a]		0.529	0.077	6.86**
Age of homemaker (A)		0.044	0.051	0.86
Race (R)[b]:				
Urban black		-0.393	0.098	4.03**
Rural black		-0.254	0.120	2.11*
Rural white		-0.208	0.106	1.97*
Educational level (E)[c]				
9th-12th grade		-0.037	0.071	0.52
<9th grade		-0.179	0.107	1.67
Nutritional education (EDNT)		-0.105	0.059	1.78*
FSP participation (FSP)		0.152	0.068	2.23*

R^2 = .3929

F = 16.44**

[a]Food expenditure, household income and household size are expressed in logarithmic form. See pages 51-52 for model specification.

[b]Hispanic group omitted.

[c]College level group omitted.

*F < 0.05 (coefficients significant at 95% level)
**F < 0.01 (coefficients significant at 99% level)

Table 13.--Statistical summary of OLS monthly food expenditure equations,[a] by household categories and selected socio-economic characteristics, Miami and Sumter County, Florida, 1980

Socioeconomic variable	Household category			
	Urban blacks n=103	Rural blacks n=40	Hispanics n=19	Rural whites n=97
	Regression results			
Intercept	2.87** (5.19)[b]	3.40** (3.66)	2.79 (1.86)	1.65** (3.21)
Household income (ln I)[a]	0.34** (3.36)	0.31 (1.78)	0.39 (1.51)	0.36** (6.50)
Household size (lnHS)[a]	0.48** (3.86)	0.67** (3.00)	0.79** (3.80)	0.46** (2.83)
Age of homemaker (A)	-0.06 (0.66)	0.27* (2.37)	-0.05 (0.26)	0.07 (0.80)
Educational level homemaker (K)				
<9th grade	-0.23 (1.39)	0.03 (0.08)	-0.86 (1.99)	0.25 (1.06)
9-12th grade	-0.20 (1.81)	-0.28 (1.26)	-0.67 (1.36)	0.16 (1.35)
Nutritional education (EDNT)	-0.08 (0.93)	-0.07 (0.47)	-0.07 (0.27)	-0.19 (1.59)
FSP participation (FSP)	0.23** (2.11)	0.10 (0.79)	-0.20 (0.81)	0.36** (2.12)
R^2 =	.3548	.4591	.7150	.4226
F =	7.46**	3.88**	3.94**	9.30**

[a] Food expenditure, household income, and household size are expressed in logarithmic form. See pages 51-52 for model specification.

[b] t-values in parentheses.

*P<0.05 (coefficients significant at the 95% level)

**P<0.01 (coefficients significant at the 99% level)

Table 14.--Statistical summary of food expenditure marginal propensity and income elasticity, by selected household characteristics, Miami and Sumter County, Florida, 1980

Category	Marginal propensity to spend (MPS)	Food expenditure income elasticity	Standard error of income elasticity
Aggregate	0.091	0.318	0.044
Race (R)			
White	0.082	0.380	0.087
Black	0.090	0.308	0.065
Hispanic	0.170	0.390	0.208
Region (L)			
Urban	0.064	0.230	0.078
Rural	0.117	0.400	0.054
FSP participation (FSP)			
Participants	0.074	0.150	0.055
Non-participants	0.097	0.390	0.058
Educational level homemaker (E)			
<9th grade	0.127	0.335	0.141
9-12th grade	0.104	0.348	0.049
Employment status homemaker (Emp)			
Employed	0.090	0.350	0.057
Unemployed	0.126	0.353	0.081
Family size (HS)			
2-4 persons	0.102	0.400	0.076
5-7 persons	0.097	0.320	0.085

[illegible] test for equality of the slope coefficients for the subgroups. Using the F-test, the regression analysis rejected the first hypothesis, while there was no sufficient evidence to reject the second.

A regression analysis was used to estimate a single equation (with intercept shifters) from the data due to the fact that the slope coefficients of the subgroup regressions were not significantly different from the aggregate. Table 12 presents coefficient estimates of the aggregate data. Although there were not significant differences between the slope coefficients of the subgroups, the regression results of the subgroups may be of interest (Table 13).

Results given in Table 12 indicate that income exerted a positive and significant impact on the value of monthly food expenditure. Since expenditure and income are expressed in logarithmic form, the value of the income coefficient is the income elasticity for food expenditure. Food expenditure-income elasticity is defined as the additional percentage change in food expenditure resulting from a one percent increase in income when all other variables are held constant. The income elasticity estimate for the aggregate sample was 0.329. The interpretation of this number is: for every one percent increase in monthly household income, monthly food expenditure increased by 0.329 percent. In other words, if household's income is increased by 10 percent, food expenditure of the household would increase by 3.29 percent. This finding is consistent with the income elasticity of 0.32 reported by Buse and Seiathe [10] from their 1960-61 BLS Consumer Expenditure Survey. However, West and Price [39] reported a lower aggregate income elasticity of 0.04 in their study of low income and black and Mexican-American households.

Estimated food expenditure-income elasticity and marginal propensities to spend (MPS) for food are presented in Table 14. The MPS were calculated by multiplying the estimated income elasticity by the corresponding ratio between mean monthly food expenditure and mean monthly income for each household category. MPS is the additional expenditure resulting from an increase in income of $1.00, when all other variables are held constant. The MPS for food ranged from a low of 0.064 for all urban households to a high of 0.170 for Hispanic households. The MPS for the aggregate sample was 0.094. This result means that for all households, for every one dollar increase in income, the value of food expenditure increased by an average of 9.4 cents.

Household Size and Other Household Characteristics

Household size was as important as household income in explaining food expenditure variations among sample households (Table 12). The coefficient estimates of 0.529 is significant and can be interpreted as the percentage increase in food expenditure as household size increases by one percent. Although it was noted above that the slope coefficients for each subgroup were not significantly different from each other, it may still be of interest to note the subgroup coefficient estimates of household size for urban black, rural black, Hispanic, and rural white households which were 0.47, 0.47, 0.79, and 0.46, respectively.

The qualitative (dummy) variables included in the expenditure model were age of the homemaker, race, education level, nutritional education and FSP participation (Table 12). All the dummy variables, except age and educational level were significant in explaining variations

in the level of food expenditures indicated by the coefficients of the race-location dummy variables in Table 12, substantial food expenditure variation existed between the groups. As indicated by the negative parameter estimates, blacks (both urban and rural) and whites (rural) spent relatively less on food than hispanics. This result suggests that cultural and locational differences can be important factors in determining value of food expenditure.

Educational level of the homemaker (E) showed no significant impact on the level of food expenditure (Table 12). Although the general educational level of the homemaker made no difference in the value of food expenditure, the homemaker's nutritional knowledge showed food expenditure variations among household groups. Nutritional education was included in the model to capture the effect of economies of size and efficiency in food procurement and meal preparation. As expected, the responsiveness of food expenditure to nutritional education was significant, as indicated by the negative regression coefficient (EDNT) in Table 12. Households where the homemaker had some type of nutritional education spent less money on food. The result suggests that households can save more money through efficiency and economies of size in food purchasing, food storing, and meal preparation if the homemaker has some nutritious education.

Participation in the FSP had a positive effect on the value of food expenditure. This suggests that food stamps distributed to the low income households increased the level of the household's food expenditure substantially.

CHAPTER VI
EMPIRICAL ANALYSIS - NUTRITIONAL COMPONENT

In this chapter the empirical results of the nutritional component of the study are discussed. The discussion is presented in three sections. The first section contains a descriptive analysis of the incidence of nutritional deficiency in terms of comparisons between races, sexes, and regions. In the second part there is a discussion of nutrient indicator variations between sample groups, and of nutrient differences of adolescents within sample groups are presented. OLS regression results of the nutrient model and discussions of how each nutrient indicator is affected by selected socioeconomic variables are presented in the third section.

Descriptive Analysis

Incidence of Nutrient Deficiency

The focal point of this analysis is the prevalence of nutrient deficiency among adolescents of different racial background, residential location and sex. The minimum threshold of each nutrient indicator is presented in Table 15. Tables 16 and 17 show the incidence of selected nutrient deficiency by race, sex and region. Specifically, the tables show the percent of sample population in each group with nutrient levels below the established norm. An individual is considered to be (nutrient) deficient if the level of that nutrient indicator is below a certain threshold. The HANES study [36], reviewed earlier, used similar three-

Table 15.—Criteria for classifying biochemical nutrient indicators at deficient and normal levels, adolescents, 12-17 years of age

Nutrient Indicator	Criterion		
	Low	Acceptable[a]	High[a]
Serum folacin (nanograms/milli)			
Male	3.0	3.0–6.0	3.0–6.0
Female	3.0	3.0–6.0	2.0–6.0
Serum iron (micrograms/deciliter)[b]			
Male	60.0	60–149	149
Female	40.0	40–119	119
Red blood cell folacin (nanograms/milli)			
Male	140.0	140–160	160
Female	140.0	140–160	160
Hemoglobin (grams/decilliter)			
Male	13.0	13.0–14.0	14.0
Female	11.5	11.5–12.5	12.5
Total protein (gm/deciliter)			
Male	6.0	6.0–8.0	8.0
Female	6.0	6.0–8.0	8.0
Vitamin C (milligram/deciliter)			
Male	0.2	–	–
Female	0.2	–	–
Vitamin B_{12} (picograms/decilliter)			
Male	200.0	–	–
Female	200.0	–	–
Hair zinc (micrograms/gram)			
Male	100.0	–	–
Female	100.0	–	–

[a]Criterion not available for Vitamin C, Vitamin B_{12}, and Zinc

[b]Deciliter = 100 milli. A microgram is written as ug

Source: Excerpted from [4,13].

aid levels for classifying biochemical nutrient parameters.

Due to the adolescent's rapid rate of growth, the requirement for nutrients increases as the synthesis of lean body tissues and blood volume increases [4]. If this increased requirement is not met with an adequate consumption of nutrients, adolescents would develop nutritional deficiency, which is likely to affect their health. The major functions, the health problems associated with deficiency, and the major food sources of the nutrients studied are presented in Appendix Table C.

One particular nutrient that has been extensively studied is iron. Several studies have reported that there is a high incidence of iron deficiency in the 12 to 16 age group in the U.S. The Ten State Nutrition Survey (TSNS) [37], the Health and Nutrition Examination Survey (HANES) [36], and the National Center for Health Statistics (NCHS) study [29] suggested that a high incidence of iron deficiency exists in most of the nation's adolescents. In this study, the level of iron status is determined by two nutrient indicators--hemoglobin and serum iron [4]. Both indicators are generally used as criteria to identify an individual's iron status. As indicated in Table 15, the minimum threshold for hemoglobin is 13 gl/dl for males and 11.5 gl/dl for females. If serum iron is used to measure the level of iron, the minimum threshold is 60 ug/dl for males and 40 ug/dl for females [37]. These two threshold guidelines are used in the discussion of the findings in the present study.

Tables 16 and 17 give the percent of sample populations in each category with nutrient levels below the norm. Considering the level of hemoglobin concentration as a measure of iron status, black adolescents generally had a higher incidence of iron deficiency than whites or

Table 16 --Incidence of adolescent nutrient deficiency by race and sex, Miami and Sumter County, Florida, 1980.

Nutrient	Criterion for low value	Adolescent category: Blacks			Whites			Hispanics		
		Total[b] n=221	Male n=112	Female n=109	Total[b] n=128	Male n=73	Female n=55	Total[b] n=31	Male n=15	Female n=16
		Percent								
Serum folacin (SF) (ng/ml)	<3.0	14.0	10.8	16.7	27.9	20.0	36.6	14.0	0.0	21.4
Serum iron (IR) (ng/ml)	<60 (Male) <40 (Female)	7.0	11.0	3.6	12.0	18.4	0.0	0.0	0.0	0.0
R.B.C. folacin (RF) (ng/ml)	<140	45.6	40.5	50.0	48.8	31.1	70.3	36.5	25.0	42.9
Hemoglobin (HGB) (g/dl)	<13.0 (Male) <11.5 (Female)	16.0	14.5	16.4	40.4	48.1	32.0	12.5	11.0	13.3
Protein (PRTN) (gm/dl)	<6.0	16.0	14.5	16.4	40.4	48.1	32.0	12.5	11.0	13.3
Vitamin C (VITC) (mg/dl)	<0.2	4.1	1.6	5.8	5.0	0.0	2.7	0.0	0.0	0.0
Vitamin B_{12} ($VITB_{12}$) (pg/dl)	<200	1.8	3.4	0.0	1.3	0.0	2.7	0.0	0.0	0.0
Hair zinc (HAIRZN) (µg/g)	<100	23.0	27.0	20.0	21.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[a]See Table 15.

[b]Totals are averages of male and female values.

Table 17.--Incidence of adolescent nutrient deficiency by race and region, Miami and Sumter County, Florida, 1980.

Nutrient	Adolescent category				
	Blacks		Whites		Hispanics
	Urban n=131	Rural n=58	Urban n=5	Rural n=101	Urban[a] n=31
	Percent				
Serum folacin (ng/ml)	11.7	21.1	20.0	28.4	14.0
Serum iron (ug/dl)	5.0	10.0	0.0	13.0	0.0
RBC folacin (ng/ml)	40.0	63.2	40.0	49.4	36.4
Hemoglobin (g/dl)	14.0	19.0	0.0	5.0	0.0
Protein (gm/dl)	10.3	40.0	20.0	42.6	12.5
Vitamin C (mg/dl)	1.7	14.8	0.0	5.3	0.0
Vitamin B_{12} (pg/dl)	2.8	0.0	0.0	1.3	0.0
Hair zinc (ug/g)	20.0	30.4	20.0	21.4	8.3

[a]No hispanic sample populations in rural Sumter County

Graphics [illegible] f black adolescents had low levels of hemoglobin, in contrast to only 3 percent for whites. Hispanics showed no prevalence of iron deficiency. By sex, the incidence of iron deficiency by this criterion was highest among black male adolescents. Twenty-four percent of black males were deficient in iron, in contrast to only 4.5 percent among black females. The corresponding percentages for white males and white females were 3.7 and 2.4, respectively (Table 15).

Rural adolescents had a higher incidence of low iron nutrient value than their urban counterparts. Nineteen percent of blacks and 5 percent of whites living in rural Sumter County had low levels of hemoglobin; in contrast, low level of hemoglobin among urban black adolescents was 14 percent. There were no subjects in the white or Hispanic category registering low values of hemoglobin (Table 17).

The other criterion generally used to interpret the prevalence of iron deficiency is the level of serum iron status in the adolescent. Considering this indicator as a criterion, there were only 7 percent of blacks and 12 percent of whites deficient in iron (Table 16); in a pattern similar to that of hemoglobin concentration, male adolescents showed higher deficiency rate in serum iron than their female counterparts. Eleven percent of black males and 18 percent of white males had low values of serum iron. The corresponding numbers for black females and white females were 3.6 and 0.0 percent, respectively. Hispanics also showed no sign of iron deficiency, by this criterion (Table 16). The serum iron nutrient indicator also suggests that rural adolescents suffered a relatively high incidence of iron deficiency. Ten percent of rural blacks and 13 percent of rural whites had serum iron levels

below the norm. The corresponding percentages among urban adolescents were 5.0 and 0.0 for blacks and whites, respectively (Table 17).

In summary, serum iron criterion suggest that the incidence of iron deficiency was highest among blacks, males, and rural adolescents. As to the choice of criterion, there seems to be no consensus as to which one is a superior determinant of iron nutriture. Both criteria are widely used by researchers. As such, it is not unusual to find conflicting results and policy recommendations.

Another important nutrient examined is folacin. Although the incidence of folacin deficiency has not been extensively studied, it is recognized that this nutrient is a dietary essential for humans [17]. In this study, the concentration of folacin in red blood cells and serum folacin concentrations are used to identify the incidence of folacin deficiency. It has been suggested, however, that the concentration of folacin in red blood cell is a better indicator of folacin than serum folacin [12]. Using red blood cell folacin as an indicator for folacin deficiency, the findings of this study indicate that a high percentage of adolescents had folacin levels below the minimum threshold in all categories (Table 16). Forty-six percent of blacks, 49 percent of whites and 36 percent of hispanics exhibited low levels of red blood cell folacin. Female adolescents showed the highest incidence of folacin deficiency. Fifty percent of black females, 70 percent of white females and 43 percent of hispanic females were below the accepted nutrient levels. The prevalence of red blood cell folacin deficiency was highest among rural adolescents. Sixty three percent of rural blacks and 49 percent of rural whites were deficient in folacin nutriture. The corresponding figures for urban blacks, urban whites, and hispanics were 40 percent, 40 percent, and 36 percent, respectively (Table 17).

In terms of serum folacin, the findings show that 14 percent of blacks, 28 percent of whites, and 14 percent of hispanics were deficient in folacin. There was a consistent pattern of relatively high incidence of serum folacin deficiency among females and rural adolescents (Tables 16 and 17)

Another nutrient that is widely known and extensively studied is protein Protein is vital in physical growth, regulation of body processes and is used as a source of energy [17]. Protein deficiency causes a disease that severely effects both the physical and mental health of a person- The findings of this study showed that all categories were affected by low levels of protein (Table 16 and 17) The incidence of protein levels below accepted norms was highest among white adolescents. Forty percent of whites had levels of protein below the norms. In contrast, the prevalence of low protein levels among blacks and hispanics were 16 percent and 13 percent, respectively (Table 16)

Rural white male adolescents exhibited the highest incidence of low protein levels (48 percent versus 15 and 11 percent for black and hispanic counterparts). Also, a high percentage of rural adolescents had a high prevalence of low protein values Forty percent of rural blacks and 43 percent of rural whites showed levels of protein below the norms compared to only 10 and 13 percent for urban blacks and urban hispanics, respectively The prevalence of low protein levels found among these sample groups is comparable to levels found in the NCHS [24] study, in which it is reported that more than 20 percent of adolescents suffered some degree of protein deficiency.

The present study also attempted to identify the zinc status of low income adolescents. The role of zinc in human nutrition is increasingly being recognized. Researchers have found cases where retarded physical development was attributed to a low dietary intake of zinc [17]. Two tissues (serum and hair) are used to provide a data base from which zinc status can be evaluated within a broad nutritional context [38] However, within the socioeconomic context of this study the decision was made to focus on hair zinc analysis. Taking 100 ug/g as the minimum norm threshold for hair zinc status, the results suggested prevalence of low hair zinc values in all adolescent groups As shown in Table 16, hispanics had less prevalence of low values of hair zinc than blacks and whites Eight percent of hispanics registered low values of hair zinc, compared to 23 percent and 21 percent for blacks and whites, respectively. Males adolescents had the highest incidence of low zinc status, Twenty seven percent of black males, 25 percent of white males and 11 percent of hispanic males were deficient in zinc Comparable figures for black, white and hispanic females were 20 percent, 17 percent, and 7 percent, respectively Rural blacks registered the highest incidence of low zinc status. Thirty percent of rural black adolescents registered deficiency in zinc status in contrast to only 21 percent among their white counterparts (Table 17).

Although this study only analyzed hair zinc status, serum zinc analysis was also undertaken by Wagner [38]. As a point of interest, Wagner reported serum zinc deficiency among 13 percent of rural blacks, 5 percent of rural whites 3 percent of urban blacks and 0 percent of urban hispanics By combining serum and hair zinc parameters to determine the zinc status of adolescents, they reported that 36 percent of rural blacks, 24 percent of rural whites, 21 percent of rural blacks,

and 10 percent of urban hispanics had low levels of serum and/or hair zinc [38]

The other nutrients examined in this study were vitamin C and vitamin B_{12}. Numerous studies indicate that a large segment of the U.S. population has inadequate intakes of vitamin C. Studies focusing on the adolescent population consistently reported vitamin C levels below acceptable standards among low-income groups. The National Center for Health Statistics (NCHS) study [24] reported more than 50 percent of adolescents in the nation were affected by a high incidence of vitamin C deficiency. In contrast, the findings of this study indicate that a high incidence of vitamin C and vitamin B_{12} deficiency did not exist among the aggregate adolescent sample population (Table 16). However, among specific sub-groups, 15 percent of rural black adolescents and 5 percent of rural white adolescents were deficient in vitamin C. No vitamin B_{12} deficiency was registered among rural blacks, and only 1 percent of rural whites had such deficiency. About 3 percent of urban blacks had vitamin B_{12} deficiency and about 2 percent had vitamin C deficiency (Table 17).

In summary, the findings of this study suggest that blacks, females, and rural adolescents were more malnourished than the other groups. In most of the nutrient indicators examined, these groups had the highest incidence of nutrient deficiency. This finding is similar to the findings of TSNS, HANES, and NCHS [37, 36, 24] which documented high prevalence of low nutrient levels for these same groups.

Group Mean Nutrient Differences

This section presents the mean values of each nutrient indicator by household category. Tables 18 to 21 show mean nutrient differences by race, sex, and location. Although a simple comparison of means using the t-test may not produce a reliable statistical inference, it may still be of interest to note the mean nutrient differences between the relevant subgroups.

Table 18 shows the mean values of each nutrient indicator for urban blacks, hispanics, rural whites and rural blacks. Among these groups, rural blacks and rural whites generally showed low mean values. In Table 19, the mean values of nutrients by race and sex are presented. In five of the eight nutrient indicators, female adolescents from all three races showed low mean levels when compared to their male counterparts. However, the mean levels of protein, vitamin B_{12} and hair zinc for female adolescents were equal or slightly higher than that of male adolescents in each race category.

The mean nutrient differences of each sex in each of the locations are given in Table 20. Among male adolescents, regional difference existed in mean levels of serum folacin, serum iron and protein. In all the three nutrients, urban adolescents showed high mean levels. Among female adolescents, the urban group had higher mean levels in protein and vitamin C than that of rural female adolescents.

The differences in the mean levels of nutrients for black adolescents is presented in Table 21. As shown in the table, urban male adolescents showed high mean values of serum folacin, serum iron, RBC folacin and protein. Among black female adolescents, there was

Table 18.—Mean nutrient differences among adolescents, by race, region, Miami and Sumter County, Florida, 1980.

Nutrient	Total	Urban		Rural	
		Black	Hispanic	White	Black
	n=353	n=163	n=31	n=101	n=58
Serum folacin (ng/ml)	7.7 (0.35)*	8.4 (0.58)	9.1 (1.69)	7.4 (0.76)	5.2 (0.47)
Serum iron (ug/dl)	100.60 (2.19)	108.5 (3.52)	106.3 (10.2)	95.7 (4.67)	86.7 (5.17)
R.B.C. folacin (ng/ml)	172.4 (5.26)	169.1 (6.86)	197.5 (24.0)	185.9 (13.4)	134.3 (5.90)
Hemoglobin (g/dl)	13.6 (0.07)	13.3 (0.10)	14.3 (0.20)	14.2 (0.12)	13.2 (0.18)
Protein (gm/dl)	7.0 (0.10)	7.6 (0.15)	7.1 (0.29)	6.0 (0.15)	6.3 (0.24)
Vitamin C (mg/dl)	1.01 (0.02)	1.10 (0.04)	1.00 (0.09)	0.90 (0.05)	0.70 (0.09)
Vitamin B_{12} (ug/dl)	412.8 (6.80)	450.5 (14.5)	390.0 (13.6)	382.5 (11.8)	442.1 (8.8)
Zinc (ug/g)	142.6 (3.37)	141.7 (6.4)	151.0 (12.6)	154.0 (6.7)	137.9 (10.9)

*Numbers in parentheses are estimated standard errors of mean.

Table 19.--Mean nutrient differences among adolescents, by race and sex, Miami and Sumter County, Florida, 1980

Nutrient	White		Black		Hispanics	
	Male n=56	Female n=47	Male n=79	Female n=92	Male n=9	Female n=15
Serum folacin (ng/ml)	8.8 (1.2)*	6.1 (0.86)	8.4 (0.81)	6.9 (0.51)	10.5 (3.6)	8.3 (1.8)
Serum iron (ug/dl)	94.3 (5.8)	89.0 (7.0)	109.2 (4.7)	96.9 (3.8)	130.0 (10.6)	87.3 (13.8)
R.B.C. folacin (ng/ml)	217.8 (17.2)	146.1 (17.0)	166.3 (8.3)	155.8 (8.2)	253.1 (53.4)	165.8 (19.4)
Hemoglobin (g/dl)	14.6 (0.14)	13.6 (0.13)	13.7 (0.14)	12.8 (0.10)	14.8 (0.32)	14.0 (0.24)
Protein (gm/dl)	5.8 (0.26)	6.2 (0.18)	7.4 (0.21)	7.3 (0.18)	7.0 (0.54)	7.1 (0.35)
Vitamin C (mg/dl)	1.00 (0.06)	0.80 (0.06)	1.10 (0.06)	1.00 (0.04)	1.10 (0.18)	1.00 (0.10)
Vitamin B_{12} (pg/dl)	358.2 (12.4)	404.7 (19.7)	447.4 (14.6)	447.4 (18.3)	353 6 (15.7)	409.6 (15.2)
Zinc (ug/g)	143.0 (8.0)	163.5 (10.4)	134.7 (9.3)	145 7 (0.4)	142.6 (22.0)	156.1 (15.6)

*Numbers in parenthases are estimated standard errors of mean

Table 70 —Mean nutrient differences among adolescents, by sex and region, Hardee and Hunter County, Florida, 1980

Nutrient	Male (n=200)		Female (n=180)	
	Urban	Rural	Urban	Rural
Serum folacin (ng/ml)	9.9 (0.82)*	7.5 (0.69)	7.1 (0.55)	5.6 (0.60)
Serum iron (ug/dl)	118.8 (3.66)	95.3 (4.25)	95.9 (4.25)	87.9 (4.77)
R.B.C. folacin (ng/ml)	185.5 (8.82)	192.0 (13.16)	153.4 (7.38)	155.9 (13.09)
Hemoglobin (g/dl)	13.9 (0.13)	14.3 (0.12)	13.10 (0.11)	13.2 (0.12)
Protein (gm/dl)	7.5 (0.21)	6.0 (0.21)	7.5 (0.16)	6.1 (0.15)
Vitamin C (mg/dl)	1.1 (0.05)	1.0 (0.05)	1.1 (0.04)	0.80 (0.06)
Vitamin B_{12} (pg/dl)	418.4 (14.43)	378.5 (10.12)	430.7 (14.40)	434.9 (15.46)
Zinc (ug/g)	136.0 (7.67)	134.0 (5.78)	145.2 (5.01)	158.0 (8.49)

*Numbers in parentheses are estimated standard errors of mean.

[illegible] nutrient [illegible]es among black adolescents by sex and [illegible]n, Miami and Dade County, Florida, 1980

Nutrient	Male (n=112) Urban n=81	Male (n=112) Rural n=31	Female (n=109) Urban n=81	Female (n=109) Rural n=27
Serum folacin (ng/ml)	9.5 (0.85)*	5.7 (0.62)	7.4 (0.63)	4.8 (0.66)
Serum Iron (ug/dl)	117.9 (4.19)	89.6 (6.48)	93.4 (4.70)	86.2 (7.27)
R.B.C. folacin (ng/ml)	177.4 (8.21)	124.2 (8.76)	158.8 (8.69)	135.5 (14.35)
Hemoglobin (g/dl)	13.7 (0.13)	13.7 (0.22)	12.9 (0.10)	12.8 (0.23)
Protein (gm/dl)	7.7 (0.21)	6.7 (0.18)	7.1 (0.19)	6.2 (0.17)
Vitamin C (ug/dl)	1.1 (0.05)	0.9 (0.15)	1.1 (0.04)	0.7 (0.10)
Vitamin B_{12} (pg/ml)	434.1 (17.53)	422.4 (17.46)	441.3 (19.30)	453.7 (28.88)
Zinc (ug/g)	135.7 (9.13)	117.0 (8.46)	142.5 (5.30)	152.4 (17.44)

*Numbers in parentheses are estimated standard errors of mean.

regional differences in protein and vitamin C In both cases, urban females had higher mean levels than that of rural females

Nutrient Regression Analysis

This section presents the results of the nutrient regression model (8) which statistically explains the impact of the households socioeconomic characteristics on the nutritional status of adolescents Included in this section is a regression analysis of interaction terms between all combinations of race, sex, and location The purpose of this regression equation is to find out whether the group classification is appropriate or not. In other words, the finding will suggest if there was a significant difference between the subgroups in each nutrient indicator.

Table 22 presents the regression results of the interaction terms As indicated by the F values in each nutrient indicator, the finding showed that there were significant differences between subgroups which suggests that nutrient classification by race, sex, and location can be appropriate. Except that of hair zinc, the F values of all nutrients were significant Insignificant F values means that there were not nutrient differences among subgroups

The regression results of the nutrient model (8) for each nutrient indicator are presented in Tables 23 to 30 The detailed model specification for equation (8) is given in Chapter IV Also results of subgroup samples are presented in Appendix Tables D-2 to D-9.[8]

[8] These tables are presented only to give a broad information across the sample groups, the numbers may not be reliable from the statistical point of view

An explicit hypothesis was that the nutritional status of the adolescent would be affected by the household's socioeconomic characteristics. Disposable household income was one of the economic factors hypothesized to positively influence nutritional status. The findings of this study suggested that no significant relationship existed between household income and the level of nutrient indicators As indicated by relatively small t-values, the general responsiveness of the nutrient indicators to changes in the level of income was not significant. This finding is inconsistent with that of the Adrian and Daniel study [1] which utilized 24-hour dietary recall method. They reported that income had a positive and significant impact on the consumption of nutrients, although nutrient consumption was found to be negatively responsive to incremental income changes at higher income levels

The size of the household was another factor hypothesized to affect nutritional status No consistent relationship was registered between family size and nutrient indicator levels. The relationship between family size and nutrient indicators, except serum iron, was not significant, as indicated by the regressing coefficients and the respective t-values The level of serum iron declined with household size at the 90 percent significance level (Appendix Table D-1)

Age of the homemaker was also hypothesized to have a negative impact on the nutritional status of the adolescent The relationship between age and the level of nutrient indicators turned out as hypothesized only for serum folacin The finding for serum folacin is consistent with that of Madden and Yoder [22], which suggested that

household Nutrient Adequacy Ratio of 10 nutrients declined with age of homemaker. The finding for serum folacin, therefore, suggests that nutritional status of adolescents from households where the homemaker's age was greater than 40 was lower than that of adolescents from households with younger homemakers. This finding and the Madden and Yoder finding [22] are not consistent with the recent findings reported by Blanciforti, Green and Lane [6], where older people were found to have a greater appreciation for more nutritious foods.

Sex of the adolescent consistently showed significant nutrient variations. For most of the nutrients, the finding indicated female adolescents had lower levels of nutrients than did their male counterparts. Specifically, the responsiveness of serum folacin, serum iron, red blood cell folacin and vitamin C was consistent and significant, female adolescents showed low levels of nutrients.

It was also hypothesized that the racial characteristics of the household would have differential impact on the nutritional status of the adolescent. Adrian and Daniel [1] found that black households consumed less calcium, thiamine, vitamin C, and iron than did either white or hispanic households. The finding of this study is consistent with that of Adrian and Daniel for nutrients, such as folacin, iron (hemoglobin), and zinc. Regression results suggests that black adolescents had low levels of red blood cell folacin, hemoglobin, and zinc. Adrian and Daniel reported that black households consumed more protein than white households.

Empirical results of this study showed general educational level of the homemaker not to be significantly related to the nutritional status of the adolescent. One possible reason for the insignificance of education could be the fact that the sample contained a small percentage of households with a college level education. This is related to the fact that this study was oriented towards relatively poor households whose educational level beyond high school was rare. It should be noted, however, that this finding is consistent with Madden and Yoder study [22], where no significant relationship was found between general educational attainment and dietary level of the family. Adrian and Daniel [1], noted an inverse relationship between educational attainment of the housewife and carbohydrate, fat, iron, and thiamine intakes.

Unlike general educational attainment, it was postulated that specialized nutrition educational attainment of the homemaker would have a beneficial effect on the dietary level of the adolescent. Findings of Davis and Neeman [14] suggested Expanded Food and Nutrition Education Program (EFNEP) impacted positively on the nutritional status of low income households. In this study, nutritional education of the homemaker was found to consistently influence the nutritional status of the adolescent. As indicated in Appendix Table D-1, nutrient indicators such as serum folacin, serum iron, red blood cell folacin, and protein were highly responsive to nutritional education. The impact was positive and statistically significant. An inverse, significant relationship was registered between nutritional education and vitamin B_{12} and zinc. No similar relationship existed for vitamin C and hemoglobin.

Table 22.—Statistical summary of OLS nutrient equation, by nutrients and dummy interaction variables, Miami and Sumter County, Florida, 1980

Independent variables	Serum folate	Serum iron	RBC folate	Hemoglobin	Protein	Vitamin C	Vitamin B_{12}	Hair zinc
Intercept	1.61**	111.11*	161.0**	11.71*	1.6**	1.11**	111.6**	118.1**
	(1.76)[b]	(11.6)	(51.0)	(0.61)	(0.6)	(0.16)	(11.1)	(10.1)
Interactions:[a]								
White and female	-1.18	49.1**	-10.0	0.25	1.69	0.01	-81.0	-11.1
	(1.10)	(21.1)	(11.2)	(0.39)	(0.10)	(0.11)	(61.1)	(36.2)
Black and female	0.19	25.9*	11.0	0.02	-0.10	-0.01	61.0	-11.6
	(2.91)	(16.1)	(61.6)	(0.10)	(0.16)	(0.10)	(56.0)	(11.1)
Black and urban	1.11	11.2	11.0	-0.11	-0.10	0.21	11.1	11.1
	(3.16)	(11.1)	(11.1)	(0.10)	(0.11)	(0.21)	(50.1)	(11.1)
Female and urban	-1.61	1.63	-58.9*	0.11	0.13	0.12	-11.0*	-18.2*
	(1.10)	(11.0)	(50.1)	(0.15)	(0.50)	(0.10)	(10.1)	(11.6)
Race:								
White	0.10	-21.0	-11.0	0.08	-0.28	-0.11	2.11	-11.0
	(1.11)	(11.1)	(12.4)	(0.66)	(0.01)	(0.21)	(11.1)	(39.2)
Black	-1.11	-16.2	-111.1**	-0.61	0.65	-0.11	11.2	-11.1
	(3.81)	(11.1)	(11.0)	(0.61)	(0.60)	(0.17)	(11.1)	(10.0)
Sex (female)	-0.26	-11.1**	-11.5	-1.11**	-1.10	-0.11	132.0**	11.1
	(1.52)	(27.0)	(11.1)	(0.56)	(6.01)	(0.16)	(11.1)	(36.1)
Location (urban)	1.56	11.7	11.1	0.11	1.15	-0.05	-1.06	-11.1
	(1.01)	(10.1)	(41.1)	(0.51)	(0.11)	(0.21)	(10.6)	(11.1)
R^2 =	0.0108	0.0801	0.1111	0.1011	0.1160	0.0111	0.1111	0.0341
F =	1.71**	1.05**	4.11**	11.1**	6.11**	1.11**	1.66**	1.10

[a]The following dummy variables were omitted to avoid problem of multicollinearity: Hispanic, male and [illegible] [illegible].

[b]Standard error in parentheses.

* $P < 0.10$ (significance at 90% level)

** $P < 0.01$ (significance at 99% level)

Participation and non-participation by households in the FSP had no significant impact on adolescent nutritional status. However, this finding cannot be conclusive since data were not available to relate how the FSP participants faired nutritionally before they effectively participated in the program. However, the findings suggest that adolescents from households, who participated in the FSP, were nutritionally equivalent to adolescents from households who did not participate in the FSP (Appendix Tables D-2 to D-9).

Adolescents from households possessing vegetable gardens were expected to have a higher nutritional level than those without gardens. However, regression results indicated no significant relationships between the household having a vegetable garden and the nutritional status of the adolescent. Detailed analysis of the response of nutrient indicator to socioeconomic variables are presented below.

Serum Folacin

A summary of the response for the aggregate sample population appears in Table 23. For the aggregate sample, the regression model explained fairly well nutrient variation associated with socioeconomic characteristics as indicated by the F-statistic which is significant at the 95 percent level (Table 23). However, when variables are considered separately, serum folacin showed no significant responsiveness to changes in income and family size (low t-values). Likewise, FSP participation by households had no significant impact on the level of adolescent serum folacin. Households with vegetable garden had no effect on the nutritional status of the adolescent. As far as serum folacin is concerned, dummy racial coefficients indicated that no significant difference existed between races (Table 23).

Table 23.—Statistical summary of OLS nutrient equation[a]; serum folacin (SF), by households and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980.

Socioeconomic variable	Regression coefficient	Standard error	t-value
Intercept	6.730	2.74	2.46**
Household income (I)[a]	0.0008	0.0008	0.98
Household size (HS)[a]	0.318	0.29	1.09
Age of homemaker (40 years (A)	-1.980	0.94	2.10**
Sex of adolescent (female) (S)	-2.180	0.90	2.42**
Race (R)			
White	-0.530	2.15	0.25
Black	-0.310	2.30	0.15
Educational level homemaker (E)			
>9th grade	0.231	1.30	0.18
<9th grade	3.320	1.99	1.67*
Nutritional education (EDNT)	1.920	0.99	1.93*
FSP-participation (FSP)	-0.790	1.19	0.66
Vegetable garden (V)	0.320	1.15	0.28

R^2 = 0.1087

F = 2.31**

[a]Nutrient level, household income, and household size are expressed in linear form. See pages 53-54 for model specification

*P < 0.10 (coefficient significant at 90% level)

**P < 0.05 (coefficient significant at 95% level).

Age of the homemaker had a negative and significant impact on the level of serum folacin. The age coefficient suggests the level of adolescent's serum folacin was reduced by 1.98 ng/ml when the age of the homemaker was greater than 40 years. This number is about 26 percent of the average, which suggests that homemakers age was a major determinant of family consumption of folacin based food groups (Tables 16 and 23).

As indicated in Appendix Table D-1, household nutritional education was a major factor associated with increasing levels of folacin, iron and protein. In the case of serum folacin, the nutrient level increased significantly by 1.92 ng/ml (25 percent of mean) for those adolescents whose homemakers had some kind of nutritional education (Tables 18 and 23). The general educational level of the homemaker also showed positive and significant impact on serum folacin when the homemaker's educational level was lower than 9th grade (Table 23).

Serum Iron

A summary of results obtained from the analysis of the aggregate sample is presented in Table 24. In the aggregate, household income and FSP participation had no significant effect on the level of serum iron. Household size had a significantly negative effect on the level of adolescent serum iron. As indicated by the regression coefficient, the level of serum iron was reduced by 2.94 ug/ml as household size increased by one person (Table 24). This result implies that a low mean value of 7.0 ug/ml (Table 15) of iron status was probably rationed among members of the household. This nutrient rationing would have had a more severe impact on larger size households with the higher incidence of poverty.

Table 24 --Statistical summary of OLS nutrient equation[a], serum iron (SR), by household and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980.

Socioeconomic variable	Total n=215	Regression coefficient	Standard error	t-value
Intercept		100.81	16.24	6.21**
Household income (I)[a]		0.0002	0.004	0.05
Household size (HS)[a]		-2.94	1.67	1.77*
Age of homemaker (<40 years) (A)		-1.21	5.53	0.22
Sex of the adolescent (female) (S)		-12.00	5.25	2.28*
Race (R):				
White		3.21	13.29	0.24
Black		5.61	12.62	0.44
Educational level homemaker (E):				
>9th grade		13.94	7.59	1.84*
<9th grade		7.17	11.75	0.61
Nutritional education (EDNT)		10.29	5.78	1.78*
FSP-participation (FSP)		3.29	6.86	0.57
Vegetable garden (V)		-10.51	6.60	1.59

R^2 = 0.0910

F = 1.85*

[a]Nutrient level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*p < 0.10 (coefficient significant at 90% level).

**p < 0.05 (coefficient significant at 95% level).

Female adolescent status had a significantly negative effect on serum iron levels. Specifically, the regression coefficient indicates that serum iron levels for female adolescents was lower by 12 ug/ml than that of male adolescents (Table 24).

Nutritional education of the homemaker significantly increased the level of adolescent serum iron in the aggregate sample. The nutrition education regression coefficient for the entire sample indicates that the level of serum iron increased by 10.3 ug/ml if the adolescent's homemaker had participated in nutritional education programs (Table 23). Among racial sub-groups, the effect of nutritional education on serum iron was greatest in the black category.

Serum iron was the only nutrient where the general educational attainment of the homemaker had a significantly positive impact on the adolescent nutrient level. As indicated by the nutrition education regression coefficient, the level of serum iron was high for adolescents whose homemaker level of education was above the ninth grade. In contrast, the level of serum iron for adolescents with homemakers with less than 9th grade education was low (Table 24).

Red Blood Cell Folacin

RBC folacin regression coefficients for the aggregate sample appear in Table 25. As indicated by the respective coefficients for the aggregate sample, household income and household size had an consistent and significant impact on the level of adolescent RBC folacin (Table 25).

The significant coefficient of nutritional education, in the aggregate sample, indicates that the level of RBC folacin increased by 32 ug/ml (18.6 percent of mean), if the adolescent's homemaker had participated in nutritional education programs (Table 25).

Table 25.--Statistical summary of OLS nutrient equation[a], red blood cell folacin (RF), by households and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980

Socioeconomic variable	Total n=216	Regression coefficient	Standard error	t-value
Intercept		206.80	39 71	5 21**
Household income (I)[a]		-0.011	0.011	0.83
Household size (HS)[a]		1 314	4.22	0.31
Age of the homemaker (>40 years) (A)	6 044	13.69	0 44	
Sex of adolescent (female) (S)	-38 11	13 16	2 89**	
Race (R):				
White		-14 61	31 06	0 47
Black		-53 48	29 25	1 83*
Educational level homemaker (E)				
>9th grade		9.29	18.74	0 50
<9th grade		2.64	28 66	0-09
Nutritional education (EDNT)		32 11	14 65	2 19**
FSP-participation (FSP)		-4.53	17 10	0 27
Vegetable garden (V)		9.60	16.91	0-57

R^2 = 0 1127

F = 2.35**

[a]Nutrient level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*P < 0 10 (coefficient significant at 90% level)

**P < 0 05 (coefficient significant at 95% level)

Hemoglobin

Hemoglobin summary response for the aggregate sample is presented in Table 26. For this nutrient indicator, income, household size, age, FSP participation and nutritional education of homemaker showed no consistent response pattern in the aggregate sample. The only variables that registered significant impacts on the level of hemoglobin were sex of the adolescent and racial background (Table 6).

In the aggregate, racial composition had a significantly negative impact on adolescent hemoglobin level. The greatest impact on the level of hemoglobin was registered among blacks, where coefficients indicated that the nutrient level would be less by 1.2 g/dl (8 percent of mean), if the adolescent was black (Table 25).

Protein

A summary of the regression analysis for this nutrient indicator is given in Table 27. The only variable that showed a significant impact was the nutritional education of the homemaker. The level of adolescent protein showed a higher level when the homemaker had some kind of nutritional education. The nutritional education coefficient suggests that adolescent protein level would have increased by 4.96 gm/dl (8 percent of mean) if the homemaker had participated in some type of nutritional education program. Thus, as expected, nutritional education of the household played a major role in improving the nutritional status of the adolescent. Household income, family size, FSP participation and vegetable garden had no significant impact on the level of adolescent protein.

Table 26.--Statistical summary of OLS nutrient equation[a], hemoglobin (HGB), by households and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980

Socioeconomic variable	Regression coefficient	Standard error	t-value
Intercept	15 34	0.39	39 50*
Household income (I)[a]	0 0001	0.0001	0.87
Household size (HS)[a]	-0.03	0.04	0.76
Age of homemaker (<40 years) (A)	0 08	0 13	0 59
Sex of adolescent (female) (S)	-1.02	0.13	7 79**
Race (R)			
White	-0 53	0 31	1.71*
Black	-1 21	0 29	4.16**
Educational level homemaker (E)			
>9th grade	-0.19	0.18	1 01
<9th grade	-0.26	0.29	0.91
Nutritional education (EDNT)	-0 09	0.14	0.67
FSF-participation (FSF)	0 02	0.17	0 11
Vegetable garden (V)	-0.08	0.15	0 50

R^2 = 0 3270

F = 10 07**

[a]Nutrient level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*P < 0 10 (coefficient significant at 90% level).

**P < 0 05 (coefficient significant at 95% level)

[illegible] 27--Statistical summary of OLS nutrient equation[a], protein (PRTN), by households and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980.

Socioeconomic variable	Total n=177	Regression coefficient	Standard error	t-value
Intercept		6.5	0.64	10.02**
Household income (I)[a]		0.002	0.002	1.27
Household size (HS)[a]		0.79	0.72	1.10
Age of homemaker (>40 years) (A)		-3.01	2.41	1.25
Sex of adolescent (female) (S)		-0.009	2.31	0.004
Race (R):				
White		-6.24	5.02	1.14
Black		5.21	4.55	1.29
Educational level homemaker (E):				
>9th grade		-4.61	3.57	1.29
<9th grade		-0.63	5.07	0.12
Nutritional education (EDNT)		4.96	2.43	2.04**
FSP-participation (FSP)		-4.31	2.92	1.47
Vegetable garden (V)		-0.38	3.32	0.11
R^2 = 0.1818				
F = 3.33**				

[a]Nutrient level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*P < 0.10 (coefficient significant at 90% level).

**P < 0.05 (coefficient significant at 95% level).

Table 28 --Statistical summary of OLS nutrient equation[a]: vitamin C (VITC), by households and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980.

Socioeconomic variable	Total n=211	Regression coefficient	Standard error	t-value
Intercept		1.08	0.17	6.03**
Household income (I)[a]		0.0001	0.00005	0.97
Household size (HS)[a]		-0.02	0.01	1.17
Age of homemaker (<40 years) (A)		-0.09	0.06	1.51
Sex of adolescent (female) (S)		-0.13	0.06	2.04**
Race (R):				
White		-0.06	0.14	0.45
Black		0.06	0.13	0.49
Educational level homemaker (E):				
>9th grade		0.03	0.09	0.30
<9th grade		0.16	0.13	1.22
Nutritional education (EDNT)		0.07	0.07	0.95
FSP-participation (FSP)		-0.02	0.08	0.23
Vegetable garden (V)		0.007	0.07	0.09

R^2 = 0.0614

F = 1.18

[a]Nutrition level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*P < 0.10 (coefficient significant at 90% level)

**P < 0.05 (coefficient significant at 95% level)

Table 29.—Statistical summary of OLS nutrient equation[a]; vitamin B_{12} ($VITB_{12}$), by households and selected socioeconomic characteristics, Miami and Sumter, Florida, 1980

Socioeconomic variable	Total n=177	Regression coefficient	Standard error	t-value
Intercept		360.93	50.84	7.09**
Household income (I)[a]		-0.002	0.016	0.13
Household size (HS)[a]		0.17	5.85	0.030
Age of homemaker (<40 years) (A)		-17.84	17.58	1.02
Sex of adolescent (female) (S)		21.00	17.01	1.23
Race (R):				
White		11.86	38.75	0.39
Blank		94.28	37.80	2.49**
Educational level homemaker (E):				
>9th grade		10.27	26.26	0.39
<9th grade		71.37	40.33	1.77*
Nutritional education (EDNT)		-32.58	18.66	1.75*
FSP-participation (FSP)		-25.78	22.61	1.74*
Vegetable garden (V)		22.10	21.20	1.04

$R^2 = 0.1294$

$F = 2.23$**

[a]Nutrient level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*P < 0.10 (coefficient significant at 90% level)

**P < 0.05 (coefficient significant at 95% level)

Table 10 --Statistical summary OLS nutrient equations[a]; hair, zinc (HAIRZN), by households and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980

Socioeconomic variable	Total n=245	Regression coefficient	Standard error	t-value
Intercept		154.08	27.01	5.70**
Household income (I)[a]		-0.004	0.008	0.57
Household size (HS)[a]		-1.47	2.91	0.50
Age of homemaker (<40 years) (A)		4.04	9.17	0.44
Sex of adolescent (female) (S)		14.75	8.83	1.67*
Race (R).				
White		1.19	21.17	0.06
Black		-5.97	19.95	0.30
Educational level homemaker (E).				
>9th grade		3.00	12.93	0.23
<9th grade		17.06	19.82	0.86
Nutritional education (EDNT)		-19.23	9.81	1.96*
FSP-participation (FSP)		-5.39	11.71	0.46
Vegetable garden (V)		5.81	11.01	0.53
R^2 = 0.0465				
F = 1.05				

[a]Nutrition level, household income, and household size are expressed in linear form. See pages 53-54 for model specification.

*P < 0.10 (coefficient significant at 90% level)

**P < 0.05 (coefficient significant at 95% level)

Vitamin C

Table 28 shows the relationships between the level of vitamin C and the various socioeconomic characteristics. The only statistically significant variable was the sex of the adolescent. For this variable, female adolescents showed lower levels of vitamin C than did male adolescents (Table 27).

Vitamin B_{12}

A summary of the regression analysis for this nutrient is presented in Table 29. For this nutrient, blacks and households with less than a 9th grade education showed positive and significant impact. Nutritional education and FSP participation affected adolescent vitamin B_{12} negatively at the 90 percent significance level.

Zinc

Zinc status responses are presented in Table 30. Regression results of the aggregate sample showed no significant responsiveness to any of the variables except sex of adolescent and nutritional education of household. Female adolescents had higher (positive) levels of zinc than males. Nutritional education of the household had a negative impact on this nutrient (Table 30).

CHAPTER VII
POLICY ANALYSIS AND IMPLICATIONS

Results of this study showed that in the aggregate, household income, household size, and FSP participation exerted a significant impact on household monthly food expenditure. There was a significant relationship between household nutritional education and monthly food expenditure. The amount of food expenditure was consistently lower for households whose homemaker had some type of nutritional education, relative to those who had none (Tables 12 and 13). Household size and FSP participation showed no consistently significant impact on the nutritional status of the adolescent. The one variable that showed a consistent pattern was nutritional education of the homemaker. In five of the eight nutrients (serum folacin, serum iron, RBC folacin, protein, vitamin C), nutritional education had a positive effect that was statistically significant in four cases.

The strongly (significant) negative relationship registered between nutritional education and food expenditure (Table 12) did not appear to have adversely affected the nutritional status of adolescents. On the contrary, as noted above, the nutritional education relationship increased the level of nutrients in 63 percent (5) of the indicators as shown by the parameter estimates for the aggregate sample (Appendix Table D-1). This result implies that nutritional education made households more food dollar and nutrient efficient. In other words, a

dollar's worth of food (both quantity and quality wise) purchased was greater for households with nutritional education than it was for those with no nutritional education. This finding is consistent with, and has similar policy implications to, that of the Davis and Neenan study [14], which found that (a) policies which combined income supplement programs such as FSP, with nutrition education program, such as EFNEP, were more effective than other programs taken individually, for increasing the nutritional status of low income households, and (b) joint FSP-EFNEP participation was nutritionally superior to a direct cash supplement program among low income households. In addition, further insight is gleaned into the importance of economies of size within a dynamic household framework. The regression analysis suggests that household size economies might have functioned as a partially equalizing force among household groups in market-place competition for food and nutrients. This relationship was suggested by the fact that the lower income and larger size household groups, who needed efficiency in food procurement and meal preparation to compete for food nutrients, were the most efficient in this regard. As shown in Appendix Table B-2, nutritional education impacted highly on large size households and less educated homemaker (<9th grade) households. These household groups were at the lower end of the income spectrum (Tables 7-9). The gains from economies of size via nutritional education tended to increase the average quantity of food purchased by these household groups. Thus, nutritional education played a key role via the economy of size phenomenon, in increasing the household's food purchasing power and nutrient status of low income adolescents in the household.

The incidence of nutrient deficiency was highest among rural adolescents, particularly blacks, where the average income of the household was the lowest. Rural households also reported low participation in EFNEP, but this was obviously related to the fact that the EFNEP program was not operational in the rural area surveyed. These findings suggest, among other things, that the "spread effect", resulting from administrative and legislative policy modifications, might have been a factor mitigating against realization of food and nutrition policy objectives among this segment of the low income population, who are at nutritional risk [9] One obvious policy implication of this observation is that family food and nutrition assistance programs must be more effectively targeted at the federal, state and local levels, if policy objectives are to be realized. These targeted policy objectives should be evaluated ex post and ex ante in terms of realized or potentially realizable efficiency and equity distribution impacts.

Federal income transfer and food assistance expenditures have expanded tremendously in the last decade. Expenditures for USDA food and nutrition programs increased from slightly more than $1 billion in 1969 to more than $10 billion in 1979 (Table 5) In spite of some evidence that funds are increasingly being channeled to these areas with evidence of hunger and malnutrition [16], there is also ample evidence that there is persistent hunger, undernutrition and malnutrition among low income segments of the U S population (Chapters

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[9] Persons considered to be at nutrition risk are those with nutrient requirement greater than that of the population at large Adolescents, as a result of their rapid growth spurt, are vulnerable to nutritional stress.

I and II). Analysis suggested that the low income population covered in this study is one such population experiencing nutritional problems. Furthermore, the magnitude of the problem is more severe among rural households. The problem is relatively more severe among rural black households. It follows therefore, that policy must be effectively targeted at these populations if policy objectives are to be realized.

Rural households exhibited the highest incidence of adolescent nutritional deficiency (Table 17). The household income - food expenditure data helped to define the boundaries of the money-related problem. In the aggregate, households with income below 75 percent of the poverty level, spent, on the average, 61 percent of their monthly income for food. Those with 75 to 100 percent of the poverty level, spent 38 percent of their monthly income on food, while those with 100 to 125 percent of the poverty level, spent 32 percent of their income for food. In contrast, those households that were "less poor" (>125 percent of the poverty level), spent 21 percent of their monthly income on food (Table 11). Rural black households registered 56 percent of the households in the below 75 percent of the poverty level status. In short, rural black households exhibited a significantly higher level of chronic poverty than any other group (Table 7). Given the relatively high incidence of poverty income among black households (and rural black households in particular), an obvious question is whether there was any income-related association between: (a) household food expenditure, and (b) adolescent nutritional status within these households. A review of the regression results and descriptive data provide some insight into the answer to this question.

The regression results indicated a positive and significant relationship between household income and monthly food expenditure for the aggregate sample. The estimated aggregate income elasticity for food expenditure was 0.32 (Table 12). This result suggests that, for every 1 percent change in monthly income, food expenditure increased by 0.32 percent, when all other variables were held constant. The estimated income elasticity for food among rural black households was 0.31. This meant that among these households, every 1 percent change in monthly income resulted in a 0.31 percent increase in food expenditure. The income elasticity for food expenditure among black households was the lowest of the four racial groups studied (Table 13). The estimated marginal propensity to spend (MPS) for food was defined as the additional monthly food expenditure resulting from a $1.00 increase in household income, with all other variables held constant. The estimated aggregate MPS for food was 0.091. This figure means that, for all households, each additional dollar of monthly income increased food expenditure by 9 cents. The MPS for food ranged from a low of $0.06 for urban households to a high of $0.117 for Hispanic households. There were no significant differences between the MPS's for black and white households (0.090 and 0.092, respectively). However, the MPS for rural households (0.064). For every additional dollar increase in monthly income, the rural household spent 11.7 cents compared to 6.4 cents for urban households (Table 14). Given the characteristics of the income elasticity and MPS for food expenditure, the question posed earlier can be restated in terms of whether there was any

dynamic relationship between these two income-related characteristics and food expenditure and nutrient status among chronically poor households.

Rural black households had the highest poverty incidence (Table 7) and the largest household size (Table 8). As indicated above, the income elasticity estimate for this household group (0.31) was the lowest among the four location-related racial groups (Table 13). As illustrated in Chapter (V), the estimated MPS for rural black households was 0.15. Comparable MPS's for urban black households, hispanics, and rural white households were 0.086, 0.17, and 0.092, respectively.

The high MPS for rural blacks and hispanics may be due to a tendency by these household groups to over report expenditures and under report household income. This might also have an effect on the corresponding income elasticities.

Food Stamp Program participation had a positive impact on rural black household food expenditure (Table 13). Descriptive analysis also indicated that 54 percent of rural black households participated in the FSP. Comparable participation rate for all households was only 28 percent. Participation rates for urban black, hispanic and rural white households were 33 percent, 36 percent and 9 percent, respectively (Table 6). Money income and household size also had a positive impact on food expenditure among rural black households. However, nutrition education had a negative impact on expenditures (Table 13). Since rural black households had the highest participation rate in FSP, and the largest family size (Table 8), it was interesting to observe how FSP

participation and household size impacted the MPS estimates. Among FSP participants, the estimated MPS was 0.074, compared to 0.097 among non-participants. This meant that for each additional $1.00, FSP participants food expenditure increased by only 7 cents compared to almost 10 cents for non-participants. Given the relatively high FSP participation rate among rural black households, it appears that a good portion of their monthly food requirements were being met by food stamp coupons. Food stamp coupons could have freed up money income for purchase of residual food items, hence the low MPS among FSP participants.

Black adolescents showed lower mean values than white adolescents for serum folacin, RBC folacin, hemoglobin, vitamin C and vitamin B_{12}. Most adolescents were found to be deficient in folacin, iron, protein and zinc. Rural adolescents had a higher incidence of nutrient deficiency than urban adolescents. However, the highest incidence of nutrient deficiency for folacin, vitamin C, zinc and hemoglobin (Table 17), was among rural black households, the households with the highest incidence of poverty. A number of policy implications were implied by these findings. One policy implication is that rural black households, as the most economically and nutritionally disadvantaged group, could have been more effectively targeted for higher levels of income transfers, food assistance, nutrition education, and employment generating programs. These programs, while not sufficient to solve the low human capital problem of the group, could have reduced the incidence of poverty and malnutrition through

the interaction of selected socioeconomic variables discussed above. For example, given the relatively high positive interactive impact of FSP participation and nutritional education on household food expenditure and adolescent nutrient levels among this group, both the benefits and coverage of these programs should have been targeted to this group. Although FSP participation rate was significantly higher among rural black households (54 percent), the interactive benefits of the program could have been higher if effective policy measures were available to elicit maximum FSP participation. A similar argument holds for an important federal nutrition education program, the Expanded Food and Nutrition Education Program (EFNEP). At the time of the survey, the EFNEP was not operational in rural Sumter county. Thus, the 7 percent of the rural black households, and 3 percent of the rural white households (Table 6), who where EFNEP participants, must have received their training in locations other than Sumter county. Also, given the relatively low level of nutritional education among rural households (Table 6), and rural black households in particular (17 percent), the case is strong that an EFNEP in Sumter county would have interacted positively with a higher level of FSP participation to improve the nutritional status of rural adolescents, particularly the blacks who were relatively more disadvantaged. The implication, in terms of our theoretical framework, is that utility of poor malnourished households could have been increased by targeting and expanding FSP and EFNEP program benefits towards these groups. Increased utility would come through interactive impact of both programs because (a) FSP as an in-kind transfer program, would have freed discretionary income for a

wider choice of consumption items, while (b) the EFNEP would have improved the mix (characteristics) of food items providing proper nutritional status.

Another policy implication stems from the observed relationships between unemployment, poverty status, household food expenditure, and adolescent nutrient level among the chronically poor. The long-run solution to income-related (poverty) undernutrition and malnutrition is to find productive employment for those able to work. Rural black households, with the highest incidence of poverty, had the second highest percentage of homemakers who were nonparticipants in the labor market (39 percent). The highest percent of nonworking homemakers was among hispanics (Table 6) This relatively high level of unemployment among povertystricken rural black households was obviously associated with the relatively high (54 percent) participation rate of this group in the FSP. National studies [21] have found that each 1 percent increase in unemployment adds an estimated 750,000 to 1 million people to the food stamp rolls Many poverty level rural black households with unemployed homemakers apparently had unfulfilled physiological need for food and nutrients This need is reflected in the large proportion of money income spent for food This unfulfilled food need was also apparent among FSP participants, since, in spite of in-kind income transfer for food, these low income households still spent almost 50 percent of their monthly money income for food (Table 11). This unfulfilled food need among FSP participating households could be one explanation why the regression analysis showed no significant nutrient

variation between adolescents from FSP participating households and those from non-participating households. Although FSP participation increased the purchasing power of the poor, it was not enough, nor was it intended to be enough, to meet the household's physiological need for food and nutrients. In other words, an effective demand for food and nutrients could have been created by reducing the income poverty among the group via increased labor force participation. FSP benefits could then play a supplementary role in expanding food and nutrient demand. Also, with a higher level of aggregate employment some public revenue expended for FSP could have been rechanneled into other areas where their opportunity cost was higher.

The Reagan administration has proposed major cuts into segments of the FSP and School Lunch Program. These are two federal programs that were intended to impact food expenditure and nutritional status of low income households. As far as the FSP is concerned, it is obvious from analysis that a reduction in funding and/or limiting the eligibility standards to the poverty line or below will eliminate many of Florida's and the nation's poor and "near poor" from the program. If alternative targeted employment generating programs are conceived and effectively implemented to offset the reduction in FSP benefits, then the negative impact on the economic well-being of the nation's poor will not be as severe. However, if this is not the case, the proposed welfare program will take a heavy toll among the poor segments of the nation. In short, the price of balancing the federal budget would have fallen unevenly on the nation's poor.

CHAPTER VIII
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Despite increasing levels of public investment in food assistance programs, the nutritional impact of such investment on low income households continues to be the subject of national debate. Although the various welfare programs have reduced the incidence of poverty, there is still no conclusive evidence whether the programs have improved the nutritional status of low income people. Several empirical studies have shown that level of income and the Food Stamp Program exert a significant impact on household food expenditures. However, the general assertion that increased food expenditure, via increased income transfer programs, has increased the nutrient intake of low income households is still uncertain and is being debated. It is obvious that further research is needed to identify and quantify relationships between socioeconomic characteristics, food expenditure and nutritional status of low income households.

Another matter for which the answer is being debated is the validity of policy recommendations based on the most common nutritional assessment data source. Most nutritional assessment has used the 24-hour dietary recall survey procedure as a source of data to determine household nutritional status. It has been argued by many persons that this method gives conflicting and inconclusive results for a number of reasons. First, it is argued that the last 24 hours food intakes cannot be unequivocally taken as representative of the food

consumption habits of the household. For some households, the recall survey might have been conducted close to a shopping day, when enough food, in terms of both quantity and quality was available for consumption. For others, it might have been conducted on a day when food intake was below normal for one reason or another. Second, as suggested by Madden and Guthrie [23], the 24-hour dietary recall method is prone to over-reporting low food intakes and under-reporting high intakes. This pattern of reporting food intakes for the last 24 hours is termed the "flat-slope syndrome" and implies a downward bias in the number of subjects with extremely low and extremely high intakes. Thus the validity of the 24-hour dietary recall method is a subject that needs further research.

Recently, there have been indications that the biochemical method of collecting nutritional data is superior and preferable to the 24-hour dietary recall. This study accepts the notion that blood and clinical tests provide a better measurement of nutritional status than a "one-time" food intake interview. Biochemical assessment, although more expensive, is likely to provide a more solid basis for nutrition policy analysis. In keeping with the demand for sound empirical analysis of the economics of nutrition, this study sought to identify some of the relevant socioeconomic variables that explain low-income household food expenditure behavior and nutrient levels of household members by means of biochemical information. Specifically, population of the present study consists of adolescents from low-income households in Miami and Sumter County, Florida. As a result of their rapid growth spurt, adolescents are particularly vulnerable to nutritional problems. These problems increase the need for sound

empirical analysis of the dynamic relationships between the socioeconomic background of the families of adolescents and the nutritional status of adolescents as a target population.

There is a significant knowledge gap with respect to the nature and dynamics of the links between (a) food expenditure levels and nutrient intake (particularly as evaluated by biochemical nutritional data), and (b) household characteristics, food expenditure and nutritional status. In addition, the problem is complicated by the fact that there are inherent dangers in generalizing the nutritional problems of the general population, as identified in national surveys, to those of target populations. National nutritional surveys run the risk of overlooking unique nutritional problems of certain segments of the population. In order to reduce the risk of such a problem, nutritional surveillance is necessary for specific populations as a basis for effective policy analysis and program implementation. It is felt that biochemical nutrition data from Florida's urban and rural low income populations can provide important information for state and national nutrition policy directed at groups with similar characteristics.

The general objective of this study was to determine the impact of various socioeconomic characteristics on household food expenditures and the nutritional status of adolescents from segments of the state's low income households. Specific objectives were to: (a) determine the relationship between the household's socioeconomic characteristics and the level of household food expenditure, (b) identify the relationship between the adolescent's nutritional status and variations in selected household socioeconomic characteristics, such as household income, family size, nutritional education, ethnicity, and age of

of the homemaker, (c) determine if the level of food consumption of the household and the nutritional status of adolescents differ significantly by race, sex, and residential location, and (d) suggest appropriate food and nutrition policies based on the results of the analyses.

The following hypotheses were developed and tested in relation to the above objectives. (a) Household income, household size and participation in the Food Stamp Program (FSP), would have a positive impact on the level of household food expenditure and on the nutritional status of the adolescents. (b) Educational level of the homemaker exerts a positive effect on the value of food expenditure. No a priori hypothesis was advanced as to how the general educational level of the homemaker affects the nutritional status of the adolescent. However, this study hypothesized that nutritional education programs, such as the Expanded Food and Nutrition Education Program (EFNEP) would have a positive influence on the nutritional status of the adolescent. (c) Age of the homemaker was hypothesized to have a negative impact on both the value of food expenditure and adolescent nutritional status. (d) Generally, racial groups, who have easy access to occupational, educational, and economic opportunities, have a better diet than other groups. To this effect, it was hypothesized that whites are less malnourished than blacks or hispanics in the state of Florida. (e) Rural households who have less access to diverse types of food stores and consumer education (nutritional education program) are more malnourished than urban dwellers. (f) The difference in malnourishment between the two regions is expected to be small since rural households tend to consume more garden vegetables than do urban

dwellers. For this reason, ownership of a vegetable garden was included in the nutrient regression equation as a dummy variable.

The data consisted of two sets of information. The first set was biochemical nutritive data for 381 adolescents --202 from urban Miami and 179 from rural Sumter. This data set was used to determine the nutritional status of the adolescent as measured by selected nutrient indicators. The nutrient indicators were the dependent variables in the nutrient model. The second data set was the socio-economic profile of the households to which these adolescents belong. Socioeconomic data were obtained from 305 households (157 from Miami and 148 from Sumter County). The two data sets were merged into a complete data set which included the biochemical nutritional data of the adolescent and the socioeconomic characteristics of the household.

The study, conceptually, followed household economic theory in which the characteristics of the household are included in the utility function. The utility function was thus defined in characteristics space rather than in goods space. This formulation means that consumption is an activity in which goods are inputs and the output is a collection of goods characteristics (nutrients), which become the arguments of the utility function. Also, utility is obtained from commodities, which are produced by the consumer unit itself through the productive activity of combined market purchased goods and services with some of the household's own time. The constraints considered in this theory were time and money income. Consumption of food serves the purpose of satisfying two basic needs -- biogenic (nutritional) and psychogenic (nonnutritional).

In line with the above theoretical framework, two household relations were used to explain the interrelationship between nutritional status, socioeconomic characteristics, and food expenditure of the household. One model dealt with food expenditures and the other with biochemical nutrient indicators. In the expenditure model, the value of food was expressed as a function of household socioeconomic characteristics that included household income and family size. In the biochemical nutrient model, values of nutrient indicators were expressed as a function of household socioeconomic variables. There were eight equations, which represent the eight nutrient indicators selected for this study. Multiple regression analysis (OLS) was used to estimate the statistical parameters.

Conclusions

Empirical results indicate that nutritional education played a key role in increasing the household's food purchasing power and nutrient status of low-income adolescents in the household. Homemakers with nutritional education were the most efficient in food procurement and meal preparation. The gains from nutritional education were highest among large-size households and less-educated homemaker households, where the average household income was the lowest. This result indicates that poor and large-size households were more efficient in allocating their limited resources when they participated in some type of nutritional education program.

The highest incidence of nutrient deficiency was among rural households. One policy implication is that rural households, as the most nutritionally disadvantaged group, could have been more

effectively targeted for higher levels of income transfers, food assistance and nutrition education programs. In terms of our theoretical framework, the utility of malnourished households could have been increased by targeting and expanding FSP and EFNEP program benefits towards these disadvantaged segments of the population.

The relatively high level of FSP participation rate among rural black households was associated with a relatively high labor force non-participation rate among homemakers in this group. The policy implication of this finding is that coordinated public, private, federal, state and local activities should be directed at reducing the level of nonparticipation in the labor force. By reducing the labor force non-participation rate, some of the public revenue expended for FSP could be rechannelled into other areas where their opportunity cost is higher. If alternative targeted employment generating programs are conceived and effectively implemented to offset reductions in FSP benefits then the negative impact on the economic well-being of the nation's poor will not be as severe. If no alternative remedies are implemented, the current administration's proposed welfare program, which is associated with the desire to balance the federal budget, will fall disproportionately heavy on the nation's poor.

The findings in the current study indicate that Congress should seriously consider increasing allocations to food assistance and nutrition education programs rather than reducing these allocations. Ways should be found to improve the efficiency and distributional impact of program benefits so that the benefits accrue to the truly needy. One way of accomplishing this objective is to effectively target

the programs and benefits to these groups; that for a number of reasons, need these programs to attain higher levels of economic and physical well-being.

Recommendations

The present study did not provide answers to all of the factors associated with nutritional problems of low-income households. The study would have been more complete if the following aspects were included in the analysis: (a) analysis of the 24-hour dietary recall, and statistical comparisons between the dietary nutrient recall parameters and the biochemical nutrient parameters, (b) a larger sample size, specifically for urban whites and hispanics, (c) data on individual food items and food groups, thus making it possible to have a response analysis for each food group, (d) nutrition and socioeconomic data series from an earlier period to facilitate comparative analysis between the pre-programs (FSP and EFNEP) food expenditure and adolescent nutrient status and post-program status for these levels. Another limitation of the study was that the survey response for total household income may have included the value of food stamps for some FSP participant households but not for others. Some of the households were unwilling to report their food stamp values.

In spite of aforementioned shortcomings, the empirical findings did identify important relationships that have national significance for food and nutrition policy. In addition to the policy recommendations suggested above, the findings provide a basis for the following recommendations:

(a) Inter-disciplinary econutrition research should continue and be intensified. To have an effective food and nutrition data base, interdisciplinary teams of scientists from the disciplines of nutrition, economics, sociology, health and

medicine, to name a few, should be encouraged and supported to undertake comprehensive studies of hunger and malnutrition problems in the U.S. Studies should focus on nutrition surveillance and socioeconomic factors associated with nutritional problems. Nutrition surveillance should include identification of target populations who are at nutritional risk levels. Reliable techniques and methods of measuring nutritional levels should be developed and adopted. Also, federal nutritional research programs and support should be broadened to include the socioeconomic cultural, and political problems associated with basic nutritional problems.

(b) Federal and state food assistance programs should give emphasis to nutritional education. Programs such as the Expanded Food and Nutrition Education Program (EFNEP). An important aspect of program upgrading would be an educational program to increase the awareness of program eligibles to the relationship between food, nutrition and health. Program eligibility criteria for a number of welfare programs might have to be amended to include enrollment in nutrition education programs, if nutrition objectives are to be an integral part of welfare programs.

(c) Federal income-transfer and food assistance programs should be distributed fairly enough to include most of the needy. The findings of this study suggested that there were some element of skewness towards urban areas. Given the relatively high incidence of poverty, unemployment, and malnutrition among the rural population, it is

obvious that antipoverty and nutritional programs were not allocated to this population in relation to relative need.

(d) Greater effort is needed to increase the economic base of rural poverty areas. Such an effort would require the goodwill, support and cooperation of the local communities, the business sector, local, state, and federal government. Two important ingredients for breaking the vicious circle of poverty and malnutrition in rural areas are educational and occupational opportunities. This means that priority and emphasis should be given to reducing the unemployment rate in poverty areas and to providing higher levels of occupational skills to complement new occupational opportunities.

(e) Further research is needed on the following.

(1) Comparative analysis between the 24-hour dietary recall and the biochemical procedure.

(2) Evaluation of the nutritional status of low-income households on a continuous basis so that the impact of the income-transfer programs could be recorded for further implementation, and evaluation of food and nutrition policies.

(3) Increased nutritional surveillance and nutritional research at regional and local levels.

APPENDIX A

POVERTY INCOME GUIDELINES

Appendix Table A-1 --Poverty income guidelines for all states except Alaska and Hawaii, 1980

Size of family unit	Nonfarm family	Farm family
	----------Dollars----------	
1	3,790	3,250
2	5,010	4,280
3	6,230	5,310
4	7,450	6,340
5	8,670	7,370
6	9,890	8,400

For family units with more than 6 members, add $1,220 for each additional member in a nonfarm family and $1,030 for each additional member in a farm family

Source (15).

APPENDIX E

AVERAGE MONTHLY EXPENDITURE AND STATISTICAL SUMMARY OF OLS FOOD EXPENDITURE EQUATION

Appendix [illegible]—Average monthly expenditure by type of expenditure and race, Miami and Sumter County, Florida, 1980

Income/Expenditure	Urban		Rural	
	Black	Hispanic	Black	White
Household income, dollars	681.00	600.00	493.00	1154.00
Food expenditure, dollars	224.00	262.00	237.00	294.00
Percent of income	25.4	43.7	48.1	25.5
Housing expenditure, dollars	210.10	224.10	135.40	238.10
Percent of income	23.8	37.4	27.5	20.6
Clothing expenditure, dollars	84.60	46.70	85.60	57.30
Percent of income	9.6	7.8	17.4	5.0
Medical expenditure, dollars	48.20	97.40	59.30	60.90
Percent of income	5.5	16.2	12.0	5.3
Recreation, dollars	36.30	22.10	27.30	34.10
Percent of income	4.1	3.7	5.5	3.0
Transportation, dollars	53.50	50.00	81.50	137.70
Percent of income	6.1	8.3	16.5	11.9
Alcohol, dollars	15.70	30.00	12.00	13.50
Percent of income	1.8	5.0	2.4	1.2
Tobacco, dollars	15.70	18.70	13.50	26.60
Percent of income	1.8	3.1	2.7	2.3

Appendix Table B-2 --Statistical summary of OLS monthly food expenditure equation[a] by household category and selected socioeconomic characteristics, Miami and Sumter County, Florida, 1980

Independent variable	Household residence[c] Urban	Household residence[c] Rural	FSI Participation Participants	FSI Participation Non-participants	Nutritional education Yes	Nutritional education No	Family Size 1-4	Family Size 1-1	Educational level <9th grade	Educational level 9-12th
Intercept	1.19**	1.08**	1.18**	1.61**	1.98**	1.46**	1.91**	1.00**	1.52	1.11**
	(8.10)[b]	(4.71)	(8.11)	(1.11)	(5.61)	(1.10)	(5.11)	(7.41)	(1.11)	(9.36)
Household income (I)	0.11**	0.10**	0.13**	0.39**	0.11**	0.11**	0.10**	0.11**	0.46**	0.28**
	(2.11)	(1.38)	(2.64)	(6.10)	(4.21)	(5.94)	(1.11)	(4.01)	(1.10)	(5.11)
Household size (HS)	0.59**	0.11**	0.01**	0.41**	0.10**	0.50**			0.03**	0.48**
	(1.39)	(1.06)	(8.01)	(1.10)	(1.08)	(4.01)			(1.01)	(1.41)
Age of homemaker	-0.12	0.11*	0.11*	0.01	0.01	0.09	0.04	0.11	-0.03	0.01
	(1.41)	(1.15)	(1.70)	(0.08)	(0.11)	(1.16)	(0.11)	(1.11)	(0.14)	(1.16)
Ethnicity:										
White			0.08	-0.11**	-0.30**	0.60	-0.15	-0.21	-0.16	-0.19**
			(0.49)	(2.10)	(1.00)	(0.81)	(0.13)	(1.11)	(1.14)	(2.11)
Black			-0.11	-0.41**	-0.50**	-0.14	-0.10	-0.11**	0.33*	-0.48**
			(0.70)	(1.11)	(1.81)	(0.51)	(1.16)	(1.56)	(1.80)	(1.11)
Educational level										
<9th grade	-0.11	0.21	0.29	-0.16	-0.15**	0.12	0.20	-0.11		
	(1.08)	(1.11)	(1.10)	(1.11)	(1.16)	(1.13)	(1.08)	(0.11)		
9-11th grade	-0.21*	0.11	0.17	0.01	-0.11	0.02	-0.01	0.38		
	(1.94)	(1.11)	(1.84)	(0.15)	(1.11)	(0.19)	(0.11)	(0.41)		
Nutritional education	-0.04	-0.13	-0.18	0.15**			-0.08	0.11**	-0.11**	-0.11*
	(0.66)	(1.10)	(1.11)	(1.10)			(0.09)	(1.48)	(1.38)	(1.70)
FSI participation	0.08	0.11**			0.10*	0.18**	0.12	0.26**	0.10	0.11**
	(0.18)	(1.12)			(1.00)	(2.01)	(1.11)	(1.54)	(1.01)	(2.11)
R^2 =	.3111	.1101	.1211	.3611	.1111	.0090	.1061	.1015	0.4124	0.3820
F =	8.10**	12.81**	11.29**	11.36**	1.11**	12.80**	1.61**	6.21**	5.42**	11.07**

[a]Food expenditure, household income and household size are expressed in logarithmic form; see pages 48-50

[b]t values in parentheses

[c]Ethnicity variable is excluded from this sample group due to high multicollinearity [illegible]

*p<0.10

**p<0.05

APPENDIX C

FUNCTIONS, PROBLEMS AND FOOD SOURCES OF SELECTED NUTRIENTS

Appendix Table C-1 —Functions, problems associated with deficiency and food sources of selected nutrients

Nutrient	Nutrient indicator	Major function	Problems associated with deficiency	Major food sources
Iron	Hemoglobin Serum iron	Necessary for formation of hemoglobin, the oxygen-carrying pigment of red blood cells. Needed for growth, menstrual losses.	Weakness and fatigability. Severe deficiency leads to anemia. Serum Iron and Hemoglobin are indicators.	Liver, organ meats, leafy vegetables, dried fruits and cereals
Folacin	Serum Folacin Red Blood Cells Folacin	Stimulate regeneration of red blood cells and hemoglobin. Helps in transferring and conversion of one substance to another. Involved in blood formation	Toxemia of pregnancy, rheumatoid arthritis. Severe deficiency leads to fetal damage and depletion of maternal reserves.	Pork liver, carrots, asparagus, kidney beans, round steak
Protein	Total Protein	Essential for normal growth and development, for maintenance and repair of body tissue. Regulates the distribution of fluid, prevents accumulation of too much acid, stimulates antibodies to help combat infection	Kwashiorkor—impairs growth, weak muscles, hair and skin, diarrhea and anemia. Ability to combat infection very low.	Peanut butter, dried milk, dried peas, soy protein, cheese, tuna, eggs, liver, hen and hamburger

Appendix Table C-1 --Continued

Vitamin C	Vitamin C	Plays a major role in normal resistance to infections. Production of intercellular cementing substance, wound healing. Helps in utilization of iron, calcium and folic acid	Fatigue, weakness, muscle cramps, aching bones, shortness of breath. Decreased physical performance, delayed wound healing	Citrus fruits, broccoli, tomatoes, green pepper, raw cabbage, strawberries, and mustard greens.
Vitamin B_{12}	Vitamin B_{12}	Necessary for normal growth, maintenance of healthy nervous tissue, and for normal blood formation.	Pernicious anemia.	Beef liver, clams, lamb, eggs, salmon, and beet green
Zinc	Hair Zinc	Part of enzymes involved in energy and protein metabolism maintains the integrity of skin and hair. Necessary for mobilization of Vitamin A. Essential to brain growth, reproduction	Failure to maintain pregnancy, fetal malformations, retardation	Oysters, round steak, lamb chops, peanut whole wheat, nuts and beans.

Source: Adopted from [17].

APPENDIX D

STATISTICAL SUMMARY OF OLS NUTRIENT EQUATIONS

Appendix Table D-1.--Statistical summary of OLS nutrient equation by nutrients and selected socio-economic characteristics, Miami and Sumter County, Florida, 1980.

Independent variable	Serum lipids N=220	Serum Iron N=333	Red blood cell folate N = 339	Hemoglobin N=340	Protein N=333	Vitamin C N=313	Vitamin B_{12} N=333	Hair zinc N=349
Intercept	9.39**	105.01**	204.05**	33.34**	9.3**	3.08**	369.95**	154.03**
	(3.49)*	(4.31)	(3.33)	(33.50)	(30.02)	(9.03)	(3.10)	(5.30)
Income	0.0008	0.0035	-0.033	0.0001	0.0034	0.0003	-0.003	0.004
	(0.98)	(0.03)	(0.93)	(0.03)	(1.33)	(0.93)	(0.13)	(0.33)
Household size	0.33	2.94*	3.33	0.03	0.39	-0.03	0.33	1.43
	(3.09)	(3.38)	(0.51)	(0.39)	(1.30)	(3.33)	(0.03)	(0.50)
Age (homemaker)≥43	3.98**	-3.23	9.34	0.08	-3.01	-0.10	-13.04	4.04
	(3.30)	(0.23)	(0.44)	(0.59)	(1.33)	(1.51)	(1.03)	(0.44)
Sex (adolescent female)	3.38**	-13.0**	38.13	3.32**	-0.030	-0.33**	30.96	14.35*
	(3.43)	(2.38)	(2.09)	(3.39)	(0.004)	(3.04)	(1.33)	(3.93)
Race								
B_1 White	-0.53	3.31	-34.93	-0.354	-6.24	-0.95	13.88	3.19
	(0.23)	(0.34)	(0.49)	(3.33)	(3.34)	(0.45)	(0.31)	(0.03)
B_2 - Black	0.33	5.93	33.40	-3.33**	3.33	0.00	94.28**	-5.35
	(0.13)	(0.44)	(3.85)	(4.39)	(1.33)	(0.49)	(3.30)	(0.30)
Education level	0.33	35.34**	9.39	-0.19	-4.93	0.03	10.23	5.01
B_1 - 9-12th grade	(0.38)	(1.84)	(0.30)	(3.03)	(3.29)	(0.30)	(0.39)	(0.23)
	3.53	3.33	3.44	-0.39	0.93	0.39	31.33*	37.08
B_2 <9th grade	(1.93)	(0.91)	(0.09)	(0.91)	(0.13)	(1.33)	(1.33)	(0.80)
Nutritional education homemaker participated	3.92*	30.39*	33.33**	0.030	4.96**	0.03	-33.58*	-39.32*
	(1.33)	(3.30)	(3.19)	(0.93)	(3.04)	(0.95)	(3.35)	(3.94)
Food stamp program participated	-0.39	5.92	-4.35	0.03	-4.33	-0.03	33.38*	-5.59
	(0.49)	(0.33)	(0.23)	(0.33)	(3.43)	(0.34)	(3.34)	(0.46)
Vegetable garden (planted)	0.32	38.51	9.90	-0.08	0.38	0.003	23.30	3.81
	(0.38)	(3.33)	(0.56)	(0.50)	(0.13)	(0.99)	(1.04)	(0.33)
F-statistic	3.31**	3.83*	3.35**	10.03**	3.53**	1.18	3.35**	1.05
R^2	0.1803	0.0310	0.1323	0.03339	0.1010	0.914	0.3394	0.0493

*Numbers in parentheses are standard t-values
**t-values significant at P<0.10
***t values significant at P<0.05

Appendix Table D-2 --Statistical summary of OLS nutrient equation by household category, dependent variable serum folacin (SF); Miami and Sumter County, Florida, 1980.

Independent variable	Sex		Race			Location		FSF participation		Employed	
	Male N=102	Female	White	Black	Hispanic	Urban	Rural	Yes N=80	No N=480	Yes N=152	No N=63
Intercept	4.54 (4.441)*	4.09 (1.461)	0.80 (0.221)	10.48** (4.221)	41.40 (0.524)	10.48** (3.404)	4.48* (1.461)	3.84 (0.261)	8.46** (2.404)	8.79** (2.291)	1.82 (0.141)
Income	0.001 (0.021)	0.0008 (0.744)	0.002** (1.101)	-0.001 (0.024)	-0.01 (0.621)	-0.002 (1.424)	0.002** (2.224)	-0.004 (1.464)	0.001 (1.501)	0.0001 (0.641)	0.002 (1.351)
Household size	0.02 (0.041)	0.44** (1.621)	0.24 (1.421)	-0.03 (0.084)	-0.44 (0.441)	0.44 (4.491)	0.21 (0.491)	4.29** (2.761)	-0.40 (0.261)	0.14 (0.421)	0.40 (1.001)
Age^2/1	-2.88* (4.494)	-1.20 (1.491)	0.38 (0.231)	2.56** (2.131)	-40.4 (1.311)	-2.01* (1.691)	0.64 (0.504)	-3.45** (2.411)	-4.04* (4.221)	4.85 (1.844)	-4.20** (2.141)
Sex-Female			-2.94* (1.441)	-2.39** (2.001)	4.28 (0.42)	2.34* (1.094)	-2.10* (1.761)	-0.84 (0.404)	-2.83** (2.661)	3.14** (3.024)	0.42 (0.19)
Race White	1.24 (0.401) 2.49 (0.201)	-4.86 (0.04) -4.42 (0.691)						4.22 (0.501) 4.24 (0.42)	-1.11 (0.411) -0.02 (0.044)	0.49 (0.041) 0.41 (0.101)	0.10 (0.041) 0.21 (0.021)
9-12th grade	-0.16 (0.08)	0.44 (0.094)	0.02 (0.041)	0.04 (0.041)	10.7 (0.021)	0.02 (0.011)	-0.14 (0.081)	-2.56 (0.044)	0.04 (0.621)	0.04 (0.044)	2.10 (0.421)
<9th grade	0.09** (2.121)	0.31 (0.141)	3.82 (1.001)	4.04* (1.011)	12.4 (4.041)	3.02 (4.221)	2.92 (0.911)	2.02 (0.501)	2.80 (1.171)	4.69 (1.491)	4.60 (0.94)
Max education-yes	0.44 (0.081)	2.02** (2.411)	2.62 (4.451)	4.46 (4.431)	2.42 (0.261)	4.44 (0.124)	4.44 (0.921)	3.48** (2.091)	0.68 (0.691)	0.48 (0.491)	4.24** (2.121)
Vegetable garden yes	0.24 (0.384)	0.21 (0.444)	2.24 (1.441)	-1.09 (1.114)	2.66 (0.22)	-4.84 (0.244)	1.46 (1.121)	3.08 (1.444)	1.44 (1.091)	-0.51 (0.321)	2.34 (0.931)
F-statistic	4.22	1.02*	2.01**	4.01*	0.98	2.00**	1.88*	4.09**	4.40	1.32	1.44
R^2	0.1141	0.1408	0.2025	0.1203	0.4944	0.1496	0.1402	0.4621	0.0940	0.0941	0.2548

*Numbers in parentheses are standard errors

*t values significant at P<0.10

**t values significant at P<0.05

Appendix Table D-3 --Statistical summary of OLS nutrient equation by household category, dependent variable serum iron (IR),Miami and Sumter County, Florida, 1980.

Independent Variable	Sex		Race			Urbanism		FSP Participation			
	Male N=109	Female N=104	White N=81	Black N=120	Hispanic N=13	Urban N=146	Rural N=109	Yes N=60	No N=180	Yes N=164	No N=69
Intercept	129.5** (5.40)	69.2** (9.66)	150.0** (3.99)	100.8** (6.00)	134.2 (1.00)	108.6** (6.61)	108.6** (3.89)	117.4** (9.35)	99.4** (3.04)	84.9** (4.49)	124.4** (3.00)
Income	-0.008 (0.89)	0.003 (1.14)	-0.008 (1.96)	0.01 (1.40)	0.08 (0.32)	0.009 (1.16)	0.005 (0.94)	0.009 (0.30)	-0.001 (0.29)	0.006 (1.99)	0.006 (0.84)
Household size	-1.75 (0.69)	-3.82* (1.63)	-5.14 (1.49)	-3.89* (2.00)	-4.59 (0.66)	-3.91* (1.96)	-5.59 (1.16)	-1.96 (0.42)	5.54** (3.43)	-5.29** (3.199	-0.86 (0.93)
Age(X)	0.08 (0.11)	-3.96 (0.45)	5.39 (0.54)	-5.59 (0.79)	0.10 (0.003)	4.29 (0.39)	-5.56 (0.33)	-5.90 (0.68)	5.09 (0.43)	5.02 (0.32)	0.74 (1.99)
Sex-Female			0.33 (0.04)	14.5** (2.19)	-69.5 (1.09)	-91.09** (3.12)	-4.39 (0.92)	19.4 (1.499	-8.89 (1.43)	9.65 (1.96)	-11.4 (0.99)
Race-White								-23.0 (0.66)	36.5 (0.98)	9.16 (0.39)	1.00 (0.00)
								-19.3 (0.90)	13.0 (0.84)	6.14 (0.93)	4.14 (0.92)
9-12th grade	13.50 (1.94)	19.04 (1.50)	20.1* (1.00)	19.6 (1.29)	60.6 (1.09)	19.95 (1.31)	16.38 (1.44)	4.03 (0.90)	16.6** (3.00)	19.9** (2.49)	-0.92 (0.92)
<9th grade	5.96 (0.43)	16.01 (1.09)	6.56 (0.90)	20.6 (1.32)	19.01 (0.99)	0.43 (0.08)	29.9) (1.08)	-6.92 (0.29)	8.6 (0.59)	20.19 (1.20)	-19.3 (0.61)
Met education you	10.03 (1.14)	9.21 (0.99)	6.56 (0.54)	19.31** (1.69)	36.9 (0.99)	5.30 (0.84)	-11.09 (1.01)	19.09 (1.00	11.30* (1.63)	3.59 (0.49)	19.6 (1.39)
Vegetable garden-yes	10.92 (1.21)	-19.68 (1.34)	-16.42** (3.00)	2.99 (0.93)	24.9 (0.41)	10.49 (0.99)	-9.40 (0.86)	19.21 (1.14)	-10.0** (3.50)	-19.2** (3.0)	0.59 (0.00
P-stat)stic	1.49	1.19	1.66	1.84*	1.19	2.79*	0.89	0.90	5.52**	5.09**	0.96
N	1909	1193	1993	1330	2759	9063	0 0090	0 1309	0 1999	N 1440	0 1969

Appendix Table D-4.--Statistical summary of OLS nutrient equation by household category, dependent variable RDC folacin (RF), Miami and Sumter County, Florida, 1980.

Independent variable	Sex		Race			Location		FSP participation		Employed	
	Male N=404	Female N=104	White N=46	Black N=144	Hispanic N=56	High* N=314	Rural N=484	Yes N=60	No N=145	Yes N=349	No N=64
Intercept	256.3**	80.4	149.6**	481.9**	444.6	344.4**	470.0**	211.6**	400.6**	214.3**	191.8**
	14.42)[a]	(1.46)	14.40)	16.47)	(1.48)	16.94)	15.94)	13.454	(4.16)	(4.02)	12.54)
Income	-0.01	-0.008	-0.0002	-0.026*	-0.41	-0.04**	0.01	-0.42**	-0.002	-0.004	-0.02
	10.41)	(0.08)	10.01)	(4.46)	14.34)	14.344	10.34)	(3.45)	(0.46)	(3.36)	11.43)
Household size	-5.4	44.48**	4.38	0.30	4.49	5.49	0.64	16.6**	-0.94	4.14	4.05
	10.89)	(4.42)	10.46)	10.364	10.34)	10.844	10.80)	(4.00)	10.36)	(0.44)	10.14)
Age>4]	4.48	0.92	44.4	-40.4	-10.4	43.2	14.48	1.10	2.58	0.08	4.64
	10.41)	(0.46)	14.40)	10.44)	10.004	10.44)	10.44)	(0.04)	(0.46)	10.46)	(0.33)
Male-Female			36.6**	-44.4	-404.0	-48.9*	44.5**	46.6	-40.1**	-44.4**	31.4
			(4.04)	10.03)	10.95)	14.84)	(4.05)	10.44)	(4.06)	(4.44)	14.00)
Race-White	-42.3)	-45.4						84.4	-48.4	-44.8	44.4
	(0.24)	(0.43)						(3.44)	10.44)	10.44)	10.46
Black	-83.4	39.4						-44.5	44.6	-43.3**	44.4
	(4.44)	(0.44)						10.46)	1.48)	(4.48)	10.00)
4)4th grade	0.04	24.4	14.3	-0.08	14.5	21.4		-44.3	14.9	24.4	-40.3
	(0.003)	(0.90)	10.44)	10.002)	10.06)			14.04)	10.64)	10.44)	10.44)
<9th grade	-44.4	46.3	5.42	4.4	45.0			80.4	44.1	34.2	-42.5
	10.26)	10.44)	10.00)	10.30)	10.44)			1.59)	10.94)	10.84)	10.00)
Nutrition-ed	46.1**	13.2	0.42	44.4**	-48.4	44.4**	1.40	46.4**	44.2	44.4	46.4
	14.04)	10.64)	10.24)	14.44)	10.44)	12.85)	10.84)	14.00)	1.36)	1.58)	14.31)
Vegetable garden-yes	19.4	-4.24	44.4	-4.56	56.9	-44.2	30.2	44.6	19.4	4.86	-0.24
	10.84)	10.44)	10.083)	10.44)	10.49)	10.44)	14.244	1.04)	10.80)	10.34)	10.04
F statistic	1.94*	1.24	4.23	4.84*	0.46	3.34**	1.08	1.84	4.43**	4.41**	0.69
R^2	4641)	)424	)396	)324	0.4404	2)44	0844	44)5	)404	)504	4342

[a]Numbers in parentheses are student t-values.

*t statistic significant at P<0.10

**t statistic significant at P<0.05

Appendix Table D-5.--Statistical summary of OLS nutrient equation by household category, dependent variable Hemoglobin (HGB), Miami and Sunter County, Florida, 1980.

Independent variable	Sex		Race			Location		FSP participation		Employed	
	Male N=121	Female N=119	White N=92	Black N=129	Hispanic N=18	Rural N=114	Urban N=124	Yes N=64	No N=116	Yes N=161	No N=22
Intercept	15.44**	14.10	14.98**	14.02**	10.14**	14.65**	14.52**	14.24**	12.48**	15.41*	14.92**
	(22.40)[a]	(22.42)	(20.15)	(34.51)	(9.93)	(26.06)	(22.10)	(14.43)	(22.04)	(20.06)	(22.06)
Income	0.0001	0.0001	0.0002	0.0000	-0.002	-0.0001	0.0002	0.0001	0.0001	0.0002	0.0001
	(0.02)	(0.22)	(1.29)	(0.02)	(1.43)	(0.61)	(1.22)	(0.28)	(1.00)	(1.02)	(0.21)
Household size	-0.06	0.02	0.06	-0.02	0.09	0.02	-0.05	0.01	-0.04	-0.02	-0.02
	(1.20)	(0.26)	(0.86)	(0.29)	(0.62)	(0.44)	(0.26)	(0.16)	(0.86)	(0.24)	(0.56)
Age≥41	0.20	-0.02	-0.10	-0.25	-0.18	0.03	-0.11	(0.25)	0.02	0.15	0.12
	(0.94)	(0.19)	(0.42)	(1.22)	(0.39)	(0.12)	(0.51)	(1.06)	(0.14)	(0.92)	(0.06)
Sex-Female			-1.02**	-1.04**	-1.03	-1.04**	-1.28**	-0.01**	-1.05**	1.19**	-0.69**
			(4.22)	(5.52)	(1.28)	(2.11)	(2.22)	(2.49)	(2.20)	(2.49)	(2.22)
Race-White	-0.20	-0.42						0.40	-0.29*	-0.24*	-0.21
	(1.20)	(1.101)						(0.28)	(2.10)	(1.68)	(1.10)
Black	1.25**	1.10**						-0.06	-1.48*	-1.26*	-1.02*
	(2.26)	(2.16)						(1.28)	(4.26)	(3.42)	(2.62)
9-12th grade	-0.06	-0.23	-0.18	-0.22	1.20	-0.58**	0.09	-0.00	0.29	-0.16	0.06
	(0.22)	(1.26)	(0.69)	(0.81)	(1.06)	(2.09)	(0.31)	(0.11)	(1.02)	(0.77)	(0.21)
≤9th grade	-0.13	-0.23	-0.24	-0.02	-0.89	-0.02	0.21	-0.51	-0.26	-0.06	0.32
	(0.64)	(0.61)	(1.38)	(0.02)	(0.96)	(0.06)	(0.32)	(0.63)	(0.20)	(0.21)	(0.52)
Home education-year	-0.24	0.06	0.06	-0.11	-1.02	0.02	-0.22	0.12	-0.14	-0.18	0.20
	(0.99)	(0.06)	(0.21)	(0.59)	(2.20)	(0.35)	(1.19)	(0.26)	(0.83)	(1.06)	(0.21)
Vegetable garden-year	-0.21	-0.02	-0.19	-0.00	0.20	-0.52*	-0.57	0.62	0.15	-0.40**	0.62**
	(0.09)	(0.06)	(0.84)	(0.20)	(0.24)	(1.80)	(0.64)	(1.40)	(1.02)	(2.06)	(2.03)
F-statistic	2.34**	2.52**	3.56**	3.20**	1.92	3.20**	2.23**	2.11**	3.20**	9.04**	2.24**
R^2	.1252	.1909	.2206	.2106	.0840	.2289	.2921	.2844	.3624	.4002	.2909

[a]Numbers in parentheses are absolute t-values.
*t values significant at P<0.10
**t values significant at P<0.05

Appendix Table D-6.--Statistical summary of OLS nutrient equation by household category, dependent variable Protein (PRTN), Miami and Sumter County, Florida.

Independent variable	Sex		Race			Location		FSP participation		Employed	
	Male N=88	Female N=91	White N=10	Black N=108	Hispanic N=10	Urban N=131	Rural N=81	Yes N=51	No N=114	Yes N=111	No N=16
Intercept	58.34**	61.46**	57.19**	61.11**	91.14**	61.18**	11.85**	39.0**	33.0**	61.65**	86.14**
	(5.54)[a]	(0.36)	(1.01)	(10.13)	(2.81)	(9.90)	(0.44)	(2.42)	(0.81)	(1.06)	(5.31)
Income	-0.0006	0.0004*	0.0061	0.006**	-0.04	0.001	0.0061	0.0000	0.005	0.006**	-0.0015
	(0.39)	(1.14)	(0.33)	(1.03)	(1.63)	(1.14)	(0.08)	(0.003)	(1.21)	(1.37)	(0.06)
Household size	0.16	1.28	-0.66	0.98	1.74	1.09	-0.34	2.01*	0.31	0.10	1.18
	(0.18)	(1.41)	(0.51)	(0.16)	(1.15)	(1.10)	(0.36)	(1.18)	(0.13)	(0.41)	(1.15)
Age<54)	0.12	-4.99*	-6.91*	-4.50	25.08**	1.06	-4.11*	-2.06	-2.46	-1.61	4.55
	(0.03)	(1.11)	(1.80)	(1.53)	(2.40)	(0.30)	(1.86)	(0.45)	(0.84)	(1.21)	(0.86)
Sex-Female			4.29	1.75	33.61	-1.92	1.01	0.65	0.15	1.45	0.41
			(1.11)	(0.43)	(1.21)	(0.59)	(0.60)	(0.11)	(0.51)	(1.38)	(0.09)
Race White	1.82	1.91						8.19	-10.19	-5.31	-5.44
	(0.10)	(1.45)						(0.96)	(1.61)	(0.10)	(0.63)
Black	9.12	2.91						19.69*	0.16	6.71	5.86
	(1.11)	(0.60)						(1.95)	(0.06)	(0.98)	(0.54)
9-12th grade	1.01	-8.60*	6.31	-5.19	-1.67	-2.16	1.41	1.11	-1.61	-1.86	-5.10
	(0.31)	(1.84)	(0.90)	(1.21)	0.06	(0.40)	(0.44)	(0.31)	(1.18)	(0.45)	(0.11)
<9th grade	1.11	-2.12	1.39	1.10	4.31	-2.10	-4.70	5.98	-1.84	6.13	3.11
	(0.55)	(0.41)	(0.21)	(0.24)	(0.25)	(0.31)	(0.16)	(0.48)	(0.11)	(0.91)	(0.30)
Nut. education-yes	0.31*	1.10	5.85	5.49	-10.19	0.88	2.01	2.01	1.09**	1.86	0.31
	(1.95)	(0.69)	(1.31)	(1.13)	(0.63)	(0.21)	(0.86)	(0.18)	(2.53)	(0.83)	(0.44)
Vegetable garden-yes	-2.10	4.56	-1.14	2.39	-25.19	1.16	-2.41	9.31	3.93	-6.27	1.31
	(0.14)	(1.01)	(0.65)	(0.28)	(1.06)	(0.29)	(0.70)	(0.16)	(0.48)	(1.44)	(1.01)
F-statistic	1.82*	1.01**	3.11	3.01*	1.35	0.99	0.63	1.31	1.36**	1.39**	1.16
R^2	.3151	.1113	.3992	.1464	.6012	0.0601	0.0943	.2121	.1386	.1806	.2171

[a]Numbers in parentheses are student t-values.
*t values significant at P<0.10
**t-values significant at P<0.01

Appendix Table D-7.--Statistical summary of OLS nutrient equation by household category, dependent variable Vitamin C (VITC), Miami and Sumter County, Florida, 1980.

Independent variable	Sex		Race				Meal preparation		Income	
	Male N=26	Female N=112	White N=28	Black N=114	Hispanic N=10	Other N=116	Meal N=92	Yes N=54	No N=127	Yes N=141	No N=64
Intercept	0.524** (0.40)[a]	1.104** (4.28)	1.264** (4.84)	2.224** (2.25)	2.254** (2.52)	0.894** (2.22)	1.264** (2.61)	1.284** (2.60)	1.024** (4.92)	0.654** (2.46)	1.304** (6.25)
Income	0.00005 (0.84)	0.00004 (0.48)	0.00002 (1.05)	-0.0015** (2.12)	-0.0012** (2.12)	0.0000 (0.12)	.00006 (0.68)	.0001 (0.46)	.00002 (1.24)	.00006 (1.12)	.00002 (0.44)
Household size	-0.02 (2.06)	-0.02 (0.54)	-0.004 (1.84)	0.04 (0.22)	0.01 (0.15)	-0.01 (0.50)	0.024** (2.08)	-0.01 (0.21)	-0.04 (1.59)	-0.02 (1.11)	-0.01 (0.56)
Age-41	-0.11 (1.09)	-0.09 (0.26)	-0.17 (1.44)	0.22 (0.26)	-.22 (0.26)	-0.02 (0.24)	-0.12* (1.72)	-0.06 (0.22)	-0.11 (1.22)[a]	-0.10 (1.24)	-0.16 (1.46)
Sex-Female			-0.12 (1.65)	0.52 (1.00)	-0.52 (1.00)	-0.01 (0.02)	-0.24** (2.22)	-0.00 (0.52)	0.15* (1.20)	0.15 (1.52)	-0.04 (0.40)
Race-White	0.04 (0.12)	-0.20 (0.22)						-0.16 (0.64)	0.04 (0.24)	0.00 (0.26)	-0.02 (0.28)
Black	0.22 (1.04)	-0.02 (0.00)						-0.20 (1.26)	0.20 (1.22)	0.26 (1.25)	-0.28 (1.04)
6-12th grade	0.35 (1.24)	-0.12 (0.20)	0.14 (0.98)	.12 (0.20)	0.08 (0.26)	0.10 (0.20)	0.18 (0.70)	-0.08 (0.22)	0.02 (0.24)	0.21 (1.02)	0.40* (2.00)
<6th grade	0.38* (1.01)	-0.01 (0.02)	0.30 (1.72)	0.42) (0.00)	0.02 (0.46)	0.35 (1.39)	0.32 (1.56)	0.08 (0.20)	0.12 (0.74)	0.18 (0.66)	0.40* (1.68)
Nut education yes	-0.04 (0.26)	0.30** (1.01)	0.02 (0.12)	-0.52 (1.12)	-0.01 (0.02)	0.09 (0.60)	0.00 (0.00)	0.02 (0.22)	0.00 (1.05)	0.00 (0.04)	-0.06 (0.46)
Vegetable garden-yes	0.12 (1.12)	-0.12 (1.00)	-0.12 (1.02)	-0.26 (0.61)	0.24* (1.68)	-0.02 (0.20)	0.08 (0.60)	0.30 (1.46)	-0.04 (0.41)	-0.08 (0.56)	0.30 (1.62)
F-statistic	72	0.94	1.89	1.03	1.14	0.55	1.84*	0.86	1.29	1.10	2.02**
R^2	0904	0.0852	.1259	.5622	0.0439	1620	2630	1216	0984	0080	2021

[a]Numbers in parentheses are student t-values
*t values significant at P<0.10
**t-values significant at P<0.05

Appendix Table D-8.--Statistical summary of OLS nutrient equation by household category, dependent variable Vitamin B_{12} ($VITB_{12}$), Miami and Sumter County, Florida, 1980.

Independent variables	Sex		Race			Location		FSP participation		Employed	
	Male N=92	Female N=82	White N=29	Black N=82	Hispanic N=12	Urban N=24	Rural N=102	Yes N=42	No N=120	Yes N=110	No N=21
Intercept	369.1**	404.0*	350.2**	482.2**	299.7*	492.2**	329.1**	402.9**	299.2**	389.6**	250.2**
	(2.09)[a]	(4.55)	(2.19)	(1.02)	(2.29)	(2.56)	(9.94)	(2.11)	(9.40)	(3.92)	(2.24)
Income	0.01	0.04	-0.01	0.009	0.14	0.01	0.01	-0.10	-0.001	-0.00	0.01
	(0.22)	(1.12)	(0.92)	(0.22)	(1.401	(0.22)	(0.02)	(1.13)	(0.08)	(0.31)	(0.43)
Household size	-1.02	0.21	2.91	-2.92	-24.2*	-1.90	7.09	-9.40	0.08	-0.94	1.58
	(0.14)	(0.02)	(0.00)	(0.02)	(2.20)	(0.20)	(0.09)	(0.29)	(0.01)	(0.08)	(0.19)
Age≤41	-25.9	-0.34	-4.47	41.2	32.2	0.12	4.70	9.22	-22.2	-14.2	-3.2
	(.29)	(0.12)	(0.11)	(1.41)	(1.02)	(0.004)	(0.21)	(0.12)	(1.34)	(0.92)	(0.10)
Sex-Female			35.2	-4.02	80.1*	34.20	23.9**	2.2	22.1	15.9	21.4
			(1.47)	(0.111)	(2.08)	(1.19)	(2.38)	(0.70)	(1.17)	(0.25)	(0.91)
Race-White	0.28	29.2						-25.9	14.1	2.8	29.3
	(0.01)	(0.44)						(0.29)	(0.32)	(0.14)	(0.42)
Black	119.2**	70.2						145.1*	82.4**	42.5	123.0
	(2.24)	(1.21)						(1.28)	(2.02)	(1.12)	(0.42)
9-12th grade	1.80	15.9	5.92	10.2	5.83	56.2	28.9	-19.2	14.0	9.2	53.2
	(0.06)	(0.32)	(0.19)	(0.88)	(0.08)	(1.22)	(0.52)	(0.21)	(0.51)	(0.31)	(0.92)
<9th grade	72.0	93.0	12.4	198.2**	29.2	80.0	40.0	104.9	49.0	32.1	120.0
	(1.26)	(0.80)	(0.22)	(2.29)	(0.41)	(1.21)	(0.94)	(0.88)	(1.04)	(0.60)	(1.20)
Not education-yes	-48.9*	28.2	20.0	-41.0	29.9	-22.9**	-4.24	1(.(4	-42.9*	-24.1	-13.0
	(1.98)	(0.88)	(1.00)	(1.40)	(0.56)	(2.41)	(0.14)	(0.24)	(1.92	(1.426	(0.25)
Vegetable garden-yes	15.2	32.0	12.9	22.2	19.2*	9.40	12.17	24.92	20.2	26.9	2.94
	(0.29)	(0.88)	(0.89)	(0.60)	(2.12)	(0.14)	(0.99)	(0.88)	(0.80)	(1.04)	(0.22)
F statistic	2.28**	0.92	1.12	1.00	1.92	1.01	0.99	1.49	1.84*	1.00	1.25
R^2	.2410	.0100	.1223	.1022	.2292	.1242	.0822	.2922	.1129	.0059	.2124

[a]Numbers in parentheses are student t-values

*t-values significant at P<0.10

**t values significant at P<0.05

Appendix Table D-9.--Statistical summary of OLS nutrient equation by household category, dependent variable Hair Zinc (HAIRZN), Miami and Sumter County, Florida, 1980.

Independent variable	Sex		Race			Location		FSP Participation		Employed	
	Male N=122	Female N=121	White N=89	Black N=121	Hispanic N=10	Urban N=116	Rural N=121	Yes N=50	No N=151	Yes N=168	No N=80
Intercept	149.2** (2.22)[a]	184.2** (4.82)	129.0 (2.01)	152.1** (5.11)	188.9 (0.48)	148.2** (5.02)	189.1** (8.04)	89.8* (1.93)	178.7** (4.81)	186.3** (4.23)	178.2** (4.09)
Income	-0.005 (0.31)	-0.092 (0.22)	-0.092 (0.79)	-0.002 (0.11)	0.310 (1.00)	-0.092 (0.28)	0.004 (0.42)	0.02 (0.85)	-0.004 (0.22)	0.001 (0.10)	-0.004 (0.48)
Household size	2.21 (1.61)	3.82 (0.92)	-0.18 (0.03)	-3.08 (0.84)	12.2** (2.02)	-1.09 (0.42)	2.87 (0.88)	-5.98* (1.84)	2.46 (0.59)	4.64 (1.92)	-1.85 (0.29)
Age^2	0.02 (0.004)	0.25 (0.86)	1.21 (0.08)	-2.03 (0.25)	45.2 (1.20)	9.22 (0.81)	-5.98 (0.49)	20.9 (1.35)	-1.00 (0.09)	-2.01 (0.17)	2.04 (0.25)
Sex-Female			19.8 (1.40)	5.28 (0.84)	59.0** (2.28)	1.92 (0.14)	28.2** (2.22)	18.0 (0.84)	11.8 (1.02)	12.8 (1.08)	24.8** (1.72)
Race White	18.8 (0.22)	-6.32 (0.22)						10.1 (0.34)	-5.92 (0.25)	-8.2 (0.28)	29.2 (1.11)
Black	29.1 (0.82)	22.9 (0.25)						2.24 (0.26)	-12.3 (0.51)	-16.3 (0.432)	7.5 (0.32)
9-12th grade	13.9 (1.222)	-11.1 (0.82)	-8.92 (0.11)	30.2 (0.55)	-24.1 (1.84)	6.12 (0.24)	-1.85 (0.09)	82.8 (*1.52)	-1.24 (0.08)	11.0 (0.09)	-29.6 (1.1)
<9th grade	56.9* (1.25)	-8.2 (0.22)	-0.98 (0.02)	21.1 (0.82)	5.88 (0.12)	21.1 (0.89)	5.39 (0.18)	22.8* (1.28)	1.28 (0.09)	3.2 (0.11)	5.84 (0.22)
Mat. education-yrs	-29.4* (1.84)	-12.2 (1.21)	-40.8** (2.52)	-14.0 (1.04)	-96.7** (2.98)	8.28 (0.21)	-49.2** (5.02)	-2.68 (0.48)	-25.2** (2.09)	-26.2** (2.05)	7.8 (0.49)
Vegetable garden-yes	9.28 (0.22)	1.45 (0.09)	12.9 (0.84)	4.09 (0.21)	-78.6** (2.02)	-6.56 (0.21)	30.2 (0.81)	22.8* (1.22)	1.09 (0.08)	12.8 (*0.85)	-23.8 (1.18)
F-statistic	0.92	-0.22	1.18	0.32	2.25	0.28	1.89*	1.32	0.88	0.92	1.12
R^2	0768	0450	1048	0270	8561	022	1221	1049	0494	0 0580	01448

[a]Numbers in parentheses are student t values.

*t- values significant at P<0.10

**t-values significant at P<0.02

APPENDIX E

SOCIOECONOMIC QUESTIONNAIRE

QUESTIONNAIRE

SOCIOECONOMIC PROFILE OF FAMILIES OF ADOLESCENTS
NUTRITION SURVEILLANCE PROGRAM, FLORIDA
INSTITUTE OF FOOD AND AGRICULTURAL SCIENCES
UNIVERSITY OF FLORIDA

1. Name of Parent or Guardian _____
2. ID No. _____
3. Name of adolescent _____
4. Relationship to Adolescent

(1) Mother _____
(2) Father _____
(3) Other guardian (specify)_____ _____

5. Address _____
6. Telephone No. _____
7. Years at present address _____
8. Sex

(1) Male _____
(2) Female _____

9 Age _____

10 Ethnic background

(1) White _____
(2) Black _____
(3) Spanish American _____
(4) American Indian _____
(5) Oriental _____
(6) Other_____ _____

11 Religion

(1) Protestant
(2) Catholic
(3) Jewish
(4) Moslem
(5) Other_____ _____

12 Marital status

(1) Married _____
(2) Single _____
(3) Separated _____

13. Person making greatest financial contribution to household income

(1) Mother _____
(2) Father _____
(3) Guardian _____

14 Number of persons living in the household _____ _____

15 Household composition:

(1) Male dependent over 18 _____
(2) Female dependent over 18 _____
(3) Male dependents under 18 _____
(4) Female dependents under 18 _____

("Dependent" means individual whose major support comes from the household)

16. Other dependents: (outside household)

(1) Dependents over 18 receiving financial assistance _____ _____
(2) Dependents under 18 receiving financial assistance _____ _____

17. Place of birth

(1) State (U.S.)_____
(2) Country_____

18. Length of residency (years)

(1) In place of birth _____ _____
(2) In other U S locations _____ _____
(Specify states of longest residency)

_____

(3) In other non-U S. locations Name of country(ies)

_____ _____ _____

19 Nationality

(1) U.S. by birth
(2) U.S. by naturalization
(3) Other_____

20 Highest grade completed by parents or guardian

(1) Mother
(2) Father
(3) Guardian

21 Was a vocational training program been completed by?
Code 0 no, 1 yes

(1) Mother
(2) Father
(3) Guardian

22 In what area was vocational training completed?

	Mother	Father	Guardian
(1) Business or office work			
(2) Nursing, other health related field			
(3) Trade or craft			
(4) Engineering or science technology			
(5) Agriculture or home economics			
(5) Other			

23 If vocational training was completed, how long was the training in number of months?

(1) Mother
(2) Father
(3) Guardian

24 Are you now employed? Code 0 no, 1 yes

Mother	Father	Guardian

25 If employed, for what period?

	Mother	Father	Guardian
(1) Number of weeks per year			
(2) Number of hours per week			

26. Type of current occupation:

	Mother	Father	Guardian
(1) Professional, Managerial			
(2) Clerical, skilled			
(3) Armed forces, law enforcement			
(4) Unskilled, manual			
(5) Other _____			

27. If not working now, major reason for not working:

	Mother	Father	Guardian
(1) Ill or disabled			
(2) Keeping house			
(3) No work available			
(4) Going to school			
(5) Care of young children			
(6) Care of elderly dependents			
(7) Don't care to work			

28. If not working now, have you ever worked before? Code 0 no, 1 yes

Mother	Father	Guardian

29. If worked before, what kind of job was it?

	Mother	Father	Guardian
(1) Professional, managerial			
(2) Clerical, skilled			
(3) Armed forces, law enforcement			
(4) Unskilled, manual			
(5) Other _____			

30 Income received last month by the household

(1) Wages, salary, commissions or fees. $_____

(2) Self employment
(a) Nonfarm employment $_____
(b) Farm employment $_____
(3) Unemployment compensation $_____
(4) Social Security and public pension $_____
(5) Private pension $_____
(6) Public assistance, welfare payments $_____
(7) Alimony or child support payments $_____
(8) Government civilian employee or military retirement or pensions veteran's payment $_____
(9) Contributions from persons not living in household $_____
(10) Other sources (dividends, rental income, etc.) $_____

Total. $_____

("Income" means income before deductions for income taxes, employees' social security taxes, insurance premiums, bonds, etc.)

31 Total annual household income (from all sources):

(1) Less than $2,000 _____
(2) $2,000 to $3,999 _____
(3) $4,000 to $5,999 _____
(4) $6,000 to $9,999 _____
(5) $10,000 to $14,999 _____
(6) $15,000 to $24,999 _____
(7) $25,000 and over _____

32 How often do you receive the major portion of your monthly income?

	Mother	Father	Guardian
(1) Daily	_____	_____	_____
(2) Weekly	_____	_____	_____
(3) Bi-weekly	_____	_____	_____
(4) Monthly	_____	_____	_____

33 Total household assets (real estate, stocks and bonds, automobile, savings, checking accounts, etc.)

(1) None _____
(2) Less than $5,000 _____
(3) $5,000 to $9,999 _____
(4) $10,000 to $14,999 _____
(5) $15,000 to $24,999 _____
(6) $25,000 to $100,000 _____
(7) Above $100,000 _____

34. Number of rooms in dwelling (not counting bathrooms, unused cellars and attics) _____ _____

35 Is your current dwelling owned by you or a member of the household? Code 0 no, 1 yes _____

36 What type of structure is your current dwelling:

(1) Concrete
(2) Wood
(3) Mobile Home
(4) Other (specify) _____ _____

37 If current dwelling not owned by you or a member of the household do you:

(1) Rent at commercial rate _____
(2) Rent at subsidized rate _____
(3) Other (Specify) _____ _____

38 Is public sewer and water available in dwelling?

(1) Both sewer and water _____
(2) Sewer only _____
(3) Water only _____
(4) Neither _____

39 Does dwelling have electricity? Code 0 no, 1 yes _____

40. Does the household have a refrigerator and/or deep freeze? Code 0 no, 1 yes _____

41. Type of cooking facilities

(1) Electric stove _____
(2) Gas stove _____
(3) Wood stove _____
(4) Hot plate _____
(5) Other (specify)_____ _____

42. How much did the household spend last month on the following items?

(1) Food (including restaurants) $_____
(2) Housing (rent, mortgage payment, plus utilities) $_____
(3) Clothing (monthly average) $_____
(4) Medical bills (monthly average) $_____
(5) Recreation (monthly average) $_____
(6) Transportation (fuel, bus, taxi, etc.) $_____
(7) Alcoholic beverages $_____
(8) Tobacco $_____
(9) Vitamin and diet supplements $_____
(10) Other (specify)_____ $_____

43 How many times per month does the household shop for food?

_____ _____

44 What proportion of total food expenditures went to the following food groups?

(1) Meat and related products _____ _____
(2) Dairy products _____ _____
(3) Fruits and vegetable products _____ _____
(4) Bread and grain products _____ _____
(5) Miscellaneous _____ _____

45 Who generally shops for food for the household?

(1) Mother _____
(2) Father _____
(3) Guardian _____

46 Who generally prepares the meals in the household?

(1) Mother _____
(2) Father _____
(3) Guardian _____

47 Does the household generally have a vegetable garden? Code 0 no, 1 yes _____

48 How frequent?

(1) All year _____
(2) Fall _____
(3) Winter _____
(4) Spring _____
(5) Summer _____

49 How often are fruits and fruit juices served in the household per week? _____ _____

50 How often are meat and/or seafood products served in the household per week? _____ _____

51 How often are milk and dairy products served in the household per week? _____ _____

52 Have you received nutrition counseling in the past 24 months? Code 0 no, 1 yes

	Mother	Father	Guardian
	_____	_____	_____

53 If yes, where was the knowledge obtained?

	Mother	Father	Guardian
(1) Physician	_____	_____	_____
(2) Public Health nutritionist	_____	_____	_____
(3) Health food store	_____	_____	_____
(4) Weight loss program	_____	_____	_____
(5) Neighbors and friends	_____	_____	_____
(6) Hospital dietitian	_____	_____	_____
(7) County extension (home economist agent)	_____	_____	_____
(8) Others (Specify)_____	_____	_____	_____

[illegible] feel that you have a basic knowledge of human needs [illegible] nutritional contents of food? Code 0 no, 1 yes

	Mother	Father	Guardian

55. Do you want someone to provide you with basic education on nutrition and economy of food preparation? Code 0 no, 1 yes

	Mother	Father	Guardian

56 If not, why?

(1) Don't believe in it (don't see its benefits)
(2) Don't have time
(3) Don't care to change my eating and food purchasing habits
(4) Others (Specify)_____

57 Have you ever been enrolled in an Expanded Food and Nutrition Education Program (EFNEP)?

	Mother	Father	Guardian
(1) Previously			
(2) Presently			
(3) Never			

58. Is your choice of food items primarily related to:

	Mother	Father	Guardian
(1) Nutritional value			
(2) Habit			
(3) Taste			
(4) Cost			
(5) Spouse and/or other family members tastes			
(6) Others (Specify)_____			

59 Does the household receive food stamps? Code 0 no, 1 yes

	Mother	Father	Guardian

60. If receiving food stamps, what was the monthly value of the stamps?

Mother $_____

Father $_____

Guardian $_____

61 If the household is not receiving food stamps, why?

(1) No need or disinterested
(2) Classified as not eligible
(3) Assumes not eligible
(4) Does not know about stamps
(5) Difficulty in filling out forms
(6) Stigma of welfare
(7) Need transportation
(8) Other reasons _____

62. How many times a week do you read a newspaper?

(1) Mother
(2) Father
(3) Guardian

63 How many hours a day do you listen to radio?

(1) Mother
(2) Father
(3) Guardian

64. How many hours a week do you watch television?

(1) Mother
(2) Father
(3) Guardian

65. Do you or other members of the household own an automobile? Code 0 no, 1 yes

66 Do you or other household members use public transportation other than school bus? Code 0 no, 1 yes

67. If yes, what proportion of the household's total monthly travel is by this type of public transportation?

(1) Less than 10%
(2) 10 - 25%
(3) 25 - 50%
(4) 50 - 75%
(5) More than 75%

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BIOGRAPHICAL SKETCH

Menwouyellet Meuesie was born November 2, 1949, in Debre Markos, Province of Gojjam, Ethiopia. In September, 1967, he entered the College of Business Administration of the national university then called Haile Selassie I University (HSIU). In 1970-71, he joined the national service (the Ethiopian University Service), and worked as an external auditor. He graduated in June, 1972, with a bachelor's degree in accounting, with distinction.

For four years, 1972 to 1976, he worked in three different organizations in the field of accounting and marketing. During this period he served as internal auditor, chief accountant, marketing officer and financial analyst. He was then awarded a scholarship through USAID/Ethiopian Project for graduate studies in agricultural economics/marketing at the University of Florida. He was enrolled in the Food and Resource Economics Department at the University of Florida from 1976 to 1978 and graduated in March 1978 with the degree Master of Science with a major in food and resource economics.

In 1978, Mr. Mousaie was granted a research assistantship from the Food and Resource Economics Department through an SEA/USDA competitive grant for nutrition study to work toward the Ph.D. degree. Since March, 1978, he has pursued a program leading to the degree of Doctor of Philosophy in food and resource economics.

During his graduate studies at the University of Florida Mr. Mousaie became a member of Phi Kappa Phi, a national honor society. He is currently a member of the American Agricultural Economics Association.

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He is married to Aster Kassa and they have a son named Yared.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Carlton G. Davis, Chairman
Professor of Food and Resource Economics

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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